US Army Corps of Engineers
Alaska District

Dredged Material Management Guidance

HOMER SMALL BOAT HARBOR
and
U.S. COAST GUARD CUTTER *HICKORY* BERTH
HOMER, ALASKA

March 2017

DEPARTMENT OF THE ARMY
ALASKA DISTRICT, U.S. ARMY CORPS OF ENGINEERS
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MAR 1 3 2017

Environmental Resources Section

Mr. Bryan Hawkins
City of Homer
Harbormaster Office
4311 Freight Dock Road
Homer, Alaska 99603

Dear Mr. Hawkins:

Attached for your information is the "Dredged Material Management Guidance, Homer Small Boat Harbor and U.S. Coast Guard Cutter *Hickory* Berth, Homer, Alaska," which the U.S. Army Corps of Engineers, Alaska District (Corps) prepared to guide decision makers and stakeholders that manage material annually dredged from the boat harbor and U.S. Coast Guard (USCG) berth.

Managing dredged material from the boat harbor and USCG berth has been periodically problematic, especially when, to preserve the physical integrity of Homer Spit, the City of Homer passed a 1968 ordinance prohibiting the removal of dredged material from Homer Spit. Consequently, dredged material management sites on Homer Spit were becoming more difficult to establish. In 2011, however, the City of Homer amended the subject ordinance to provide for the use and disposal of dredged material originating from Homer Spit to be available for, among many things, sale as fill material at locations off the spit. Henceforth, there would appear to be endless options available for managing the disposal and/or placement of material dredged from the harbor and USCG berth.

The Corps guidance presents a framework for identifying dredged material management options on the Homer Spit, including beneficial use opportunities. The guidance is intended to be used by a wide audience, including but not limited to, permitting authorities, State of Alaska and Federal environmental resource agencies, and the City of Homer management authorities. If the current upland dewatering/placement operations and/or locations become a concern in the future, this document should be an excellent starting point to guide discussions on alternatives. The level of engineering and environmental analyses in the guidance is cursory and is not intended to be in sufficient detail to complete dredging-related project planning, environmental assessments [as defined by the Council of Environmental Quality (40 CFR Part 1508, §1508.9)] or Corps Permit applications. The guidance also is not a Corps decision document or proposed project plan to be implemented with Federal funding.

Please direct any questions or comments about the guidance and maintenance dredging activities at the Homer SBH to Mr. Michael G. Tencza at Michael.G.Tencza@usace.army.mil or at (907) 753-2648.

Sincerely,

Wayne M. Crayton, Biologist
Environmental Resources Section

Enclosure:
Dredged Material Management Guidance, Homer Small Boat Harbor and U.S. Coast Guard Cutter *Hickory* Berth, Homer, Alaska

Dredged Material Management Guidance
Homer Small Boat Harbor
and
U.S. Coast Guard Cutter *Hickory* Berth

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List of Acronyms

AAC	Alaska Administrative Code
ADEC	Alaska Department of Environmental Conservation
ADFG	Alaska Department of Fish and Game
ADNR	Alaska Department of Natural Resources
ADOT/PF	Alaska Department of Transportation and Public Facilities
AMAP	Artic Monitoring Assessment Program
CFR	code of federal regulations
CHA	critical habitat area
CWA	Clean Water Act
DMMP	Dredged Material Management Plan
DRO	diesel range organics
DDT	dichlorodiphenyltrichloroethane
EA	environmental assessment
EIS	environmental impact statement
EHT	extreme high tide
EPA	Environmental Protection Agency
ER	environmental regulation
ESA	Endangered Species Act
FWCA	Fish and Wildlife Coordination Act
HSCP	Homer Spit Comprehensive Plan
HTL	high tide line
KBRR	Kachemak Bay Research Reserve
LEDPA	least environmentally damaging practicable alternative
MHW	mean high water
MLLW	mean lower low water
MMPA	Marine Mammal Protection Act
MPRSA	Marine Protection, Research and Sanctuaries Act
NEPA	National Environmental Policy Act
NERR	National Estuary Research Reserve
NMFS	National Marine Fisheries Service
NOAA	National Oceanic and Atmospheric Administration
NTU	nephelometric turbidity units
O&M	Operation and Maintenance
PA	Preliminary Assessment
PCBs	polychlorinated biphenyl
RHA	Rivers and Harbor Act
SAP	Special Area Permit
SBH	small boat harbor
USACE	U.S. Army Corps of Engineers
USCG	U.S. Coast Guard
USFWS	U.S. Fish and Wildlife Service
WQS	water quality standards
WRDA	Water Resources Development Act

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PREFACE

The U.S. Army Corps of Engineers (Corps) uses a phased approach to analyze a maintenance dredging project's capability to provide sufficient dredged material capacity for 20 years (USACE, 2000). The first phase, a Preliminary Assessment, determines: (1) whether there is 20 years storage capability under current disposal practices; (2) if continued dredging is economically justified; (3) the consistency of existing environmental compliance; and (4) if it is necessary to go to the second phase, i.e., the preparation of a Dredged Material Management Plan (DMMP).

A Homer Small Boat Harbor (SBH) Preliminary Assessment, prepared by the Corps in 2002, concluded that there was not sufficient dredged material storage space on the Homer Spit for 20 years. Therefore, in 2007 the Corps prepared the *Dredged Material Management Plan, Environmental Assessment and Finding of No Significant Impact for the Homer Small Boat Harbor and U.S. Coast Guard Dock, Homer, Alaska* (USACE, 2007). The Corps' recommendation was to construct permanent berms at the existing dredged material storage site, but because of its high construction costs, associated safety concerns, and at that time, unresolved conflicting land-uses on the Homer Spit, the City of Homer disapproved of the recommendation and the permanent berms were not constructed. Since then, no 20-year plan has existed to manage the material dredged from the Homer SBH and U.S. Coast Guard (USCG) berthing area.

Currently, the Corps awards 3-year contracts for annually dredging the Homer Small Boat Harbor and USCG berthing area, and the City of Homer notifies the Corps as to whether or not the existing site has the capacity to stockpile dredged material generated during the contract. If not, the City of Homer provides another location for the dredged material. It is important to note that the existing site continues to have safety concerns associated with stacking dredged material too high, as the site is adjacent to recreational-use lots (e.g. fishing lagoon, recreational vehicle parking and camping areas) and heavily trafficked roads.

In lieu of not having a DMMP, additional dredged material management sites are needed for the Corps continue its long-term maintenance dredging responsibilities at the Homer SBH. The guidance in this report presents a framework for identifying dredged material management options, including beneficial use opportunities, and the environmental compliance means to implement them. The level of engineering and environmental analyses in the report is cursory and is not intended to be in sufficient detail to complete dredging-related project planning, environmental assessments [as defined by the Council of Environmental Quality (40 CFR Part 1508, §1508.9)] or Corps Permit applications. Finally, the report is to be used by a wide audience, including but not limited to, permitting authorities, state and Federal environmental resource agencies, and Homer Port management authorities.

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1.0 INTRODUCTION

In lieu of the U.S. Army Corps of Engineers, Alaska District (Corps) not having a 20-year Dredged Material Management Plan (DMMP) for the Homer Small Boat Harbor (SBH), this report identifies and assesses a wide variety of options for managing material dredged from the Homer SBH and the U.S. Coast Guard (USCG) berthing area at the Pioneer Dock. Each option is evaluated using historical oceanographic and site-specific ecological information (Appendix A) and applying the Corps' understanding of mandates generated by applicable Federal, State of Alaska, and local government laws and regulations.

2.0 STUDY AREA

Homer Spit (Spit) is on the north side of Kachemak Bay at the southern end of the Kenai Peninsula, approximately 143 road miles from Anchorage, Alaska. The Homer SBH and USCG dock are near the tip of the Spit, which extends approximately 4.5 miles into Kachemak Bay (Figure 1). The harbor provides sheltered moorage for 1,420 vessels (920 permanent and 500 transient), and is vital to the City of Homer's economy. In addition to the harbor, the Spit has deep-water docks that serve freighters, cruise ships, large ferries, and a USCG cutter that is vital to public safety. Table 1 summarizes the Homer SBH's navigation features and dimensions.

The City of Homer's *Homer Spit Comprehensive Plan* (HSCP) describes existing conditions on the 548-acre Spit and defines a preferred 20-year development plan (City of Homer, 2011). The HSCP recommends public improvements and addresses future land use and zoning, parking, pedestrian issues, and conservation areas. The Spit's top five land use categories in 2009 were: (1) conservation, 189 acres, 34.6 percent; (2) campground, 114 acres, 21.8 percent; (3) harbor, 74 acres, 13.6 percent; (4) industrial, 62 acres, 11.4 percent; and (5) parking, 33 acres, 6.1 percent.

2.1 Harbor Development and Maintenance Dredging Background

The Homer SBH was constructed in 1961-1962 under the Rivers and Harbors Act (RHA) of July 3, 1958, and expanded in 1965 under the RHA of August 19, 1964, as amended by the Chief of Engineers on December 21, 1971. The City of Homer and State of Alaska efforts between 1968 and 1970 extended the harbor basin and protective berm. In 1985, a Corps harbor expansion project was completed, which enlarged the harbor from 16.5 acres to 50 acres and constructed an adjacent 30-acre staging area. The Local Cooperation Agreement between the Corps and the City of Homer, dated Sept 16, 1983, required the city to provide lands, easements, rights-of-way necessary for construction and assume responsibility for the non-Federal dredged mooring basin.

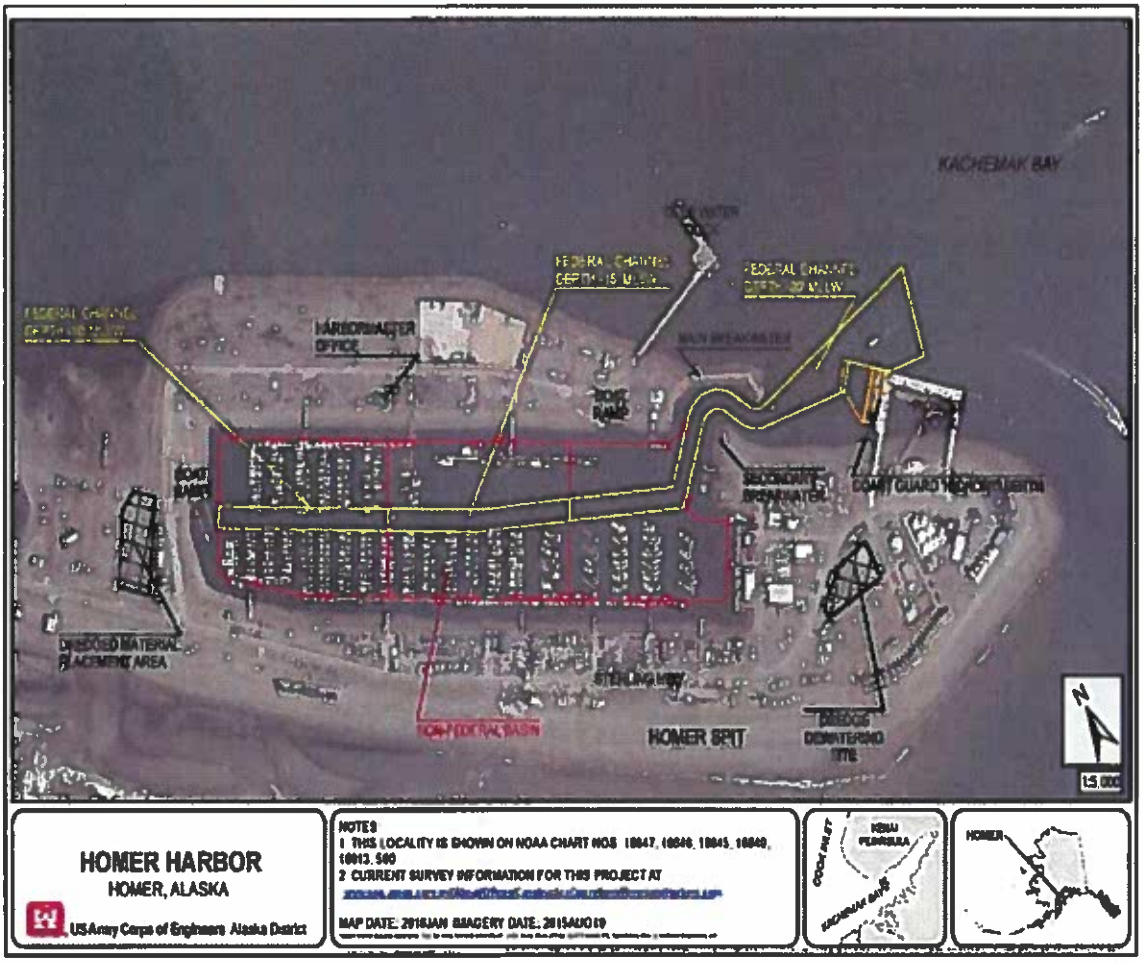

Figure 1. Homer Small Boat Harbor and vicinity, Homer, Alaska.

Table 1. Homer Small Boat Harbor features and dimensions.

Feature	Length (feet)	Depth (feet)	Width (feet)
Outer Entrance Channel	700	-20	Varies
Inner Entrance Channel	850	-20	90
Maneuvering Channel	2790	-20, -15, -10	100
Basin (50 acres)	2985	-20, -15, -10	720
Main Breakwater	1018		
Secondary Breakwater	238		

The USCG replaced its 60-year-old USCG Cutter *Sedge* with a larger, newly constructed B-class seagoing buoy tender, the USCG Cutter *Hickory*. As a result, the Corps and the USCG have a Memorandum of Understanding to dredge the USCG Cutter *Hickory's* berthing area so that the USCG could benefit from the "economy of scale" from having one dredging contractor work multiple locations on the Spit.

Between the original harbor's construction and 1976, the volume of material dredged, the employed dredging methods, and the location of dredged material disposal sites has evolved (Table 2). For many years an intertidal area near the harbor was used as a dredged material disposal site and periodically dredged material was also disposed of in deep-water off the tip of the Spit in Kachemak Bay (Figure 2) (USACE, 1974). The Corps, however, considered two other deep-water disposal sites in its Homer SBH *Operation and Maintenance Final Environmental Impact Statement* (EIS) (Figure 3) (USACE, 1974). Material dredged from the harbor in 1969 was placed on the tideland between zero-feet mean lower low water (MLLW) and +15 feet MLLW using a floating barge. It was speculated then that this disposal method "... approximately duplicates the natural sedimentation process disrupted by the entrance channel breakwaters, in that the sediments are bypassed around the end of Homer Spit." (USACE, 1974).

The Homer SBH's entrance channel has required annual maintenance dredging because of shoaling from littoral drift of material moving around the Spit and the sloughing of material from the southwest shore of the entrance channel (USACE, 1974). Because of the USCG Cutter *Hickory's* deep draft, its berthing area at the Pioneer Dock also requires annual maintenance dredging in September and April, or earlier. The remainder of the Pioneer Dock, used by freighters and ferries, has historically not needed and is not expected to need maintenance dredging. The volume of sediments dredged from the Homer SBH's entrance channel and the USCG berth from 1993 through 2013 averaged 10,096 cubic yards (cy) (Table 3). A new Alaska State Ferry terminal and USCG berth was constructed in 2002

The dredging volume figures in Table 3 do not include dredged material estimates from the city-maintained mooring basin and the Nick Dudiak Fishing Lagoon (aka The Fishing Hole), which was constructed in 1983. The city's mooring basin has not needed dredging since the harbor was expanded to 50 acres, but is planned for maintenance dredging in the next 5-to-10 years. In 2006 and 2012, the City of Homer funded maintenance dredging in the Fishing Hole and dredged material was placed on the adjacent upper intertidal zone. Also not included in Table 3 is 10,000 cy the Corps and USCG excavated in 2011 as a component of a demonstration project designed to intercept the alongshore transport of material destined to be deposited in the entrance channel and USCG berthing area.

Table 2. Summary of Homer Small Boat Harbor dredging activities, 1961-1993.

Homer Small Boat Harbor Dredging Summary 1961-1993*					
Date	Location	Approximate Volume (cubic yards)	Method	Dredging & Disposal method	Disposal location
1961-62	Original basin	128,000	Suction dredge	Pipeline	Upland area adjacent to basin
1964-66	Basin reconstruction	807,000	Suction dredge	Pipeline	Intertidal area north of basin
1968	Basin expansion	Unknown	Dragline	Trucked	Fill area at airport
1969	Entrance channel maintenance	16,000	Clamshell	Unknown	Intertidal area – unknown
1969-70	Basin and berm extension	Unknown	Dragline	Trucked	Fill area at airport
1972-73	Entrance channel maintenance	18,400	Clamshell on barge	Barge, front-end loaders	Intertidal area and shallow water – unknown; possible deep water off tip of Homer Spit.
1974	Entrance channel maintenance	9,000	Clamshell on barge	Barge, front-end loader, dozer, dump trucks	Intertidal area north of basin and deep water off tip of Homer Spit.
1975	Entrance channel maintenance	8,000	Clamshell on barge	Scow	Upland city property adjacent to channel.
1976-93	Entrance channel maintenance	Between 1,300 and 14,000 each year	Suction dredge	Pipeline to dewatering site; material trucked to disposal area.	Upland dewatering site south of harbor and upland disposal site northwest of harbor.

* Information obtained from U.S. Army Corps of Engineers Alaska District maintenance dredging project files.

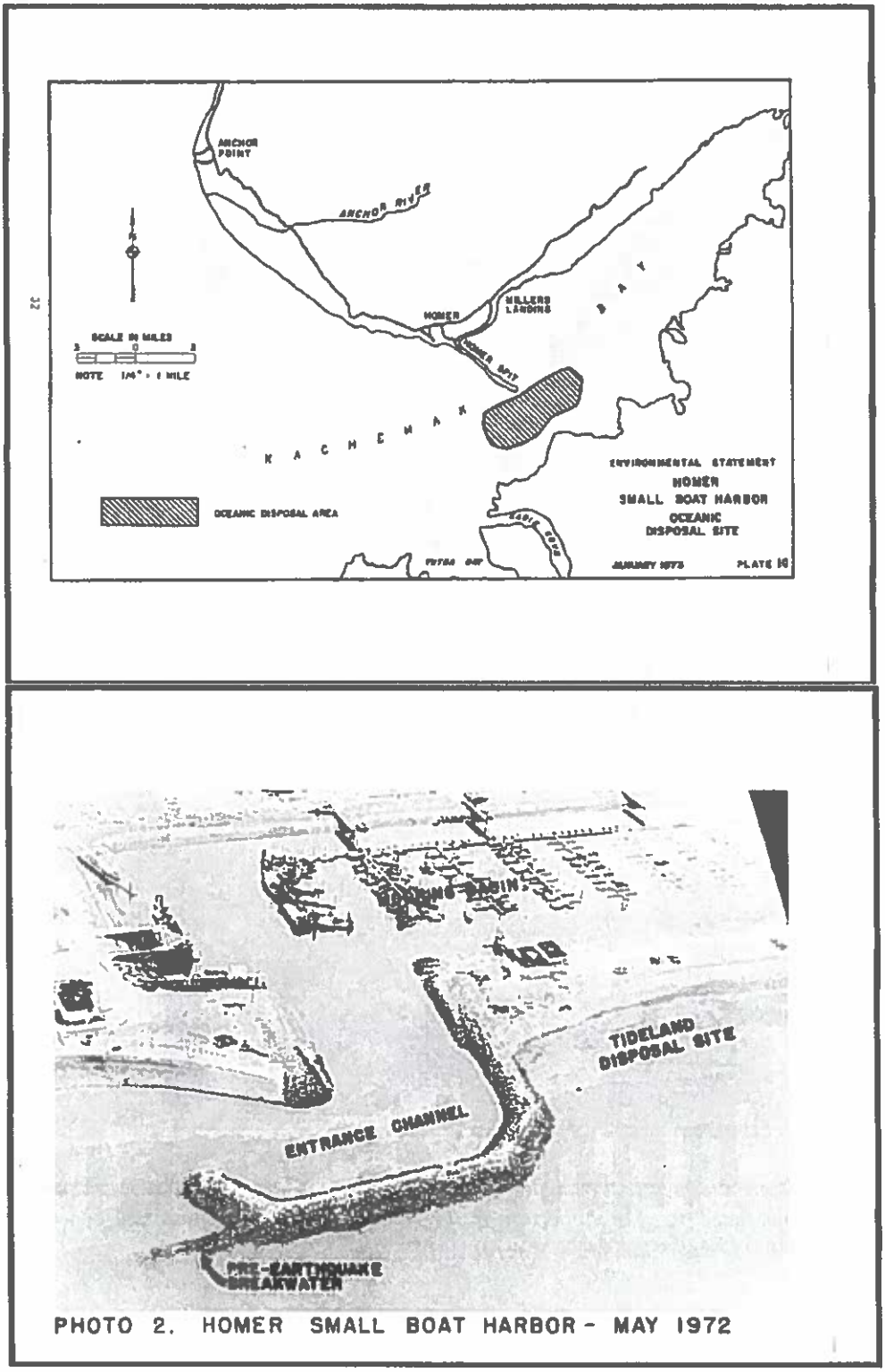

Figure 2. Homer Small Boat Harbor historic dredged material disposal sites (USACE, 1974).

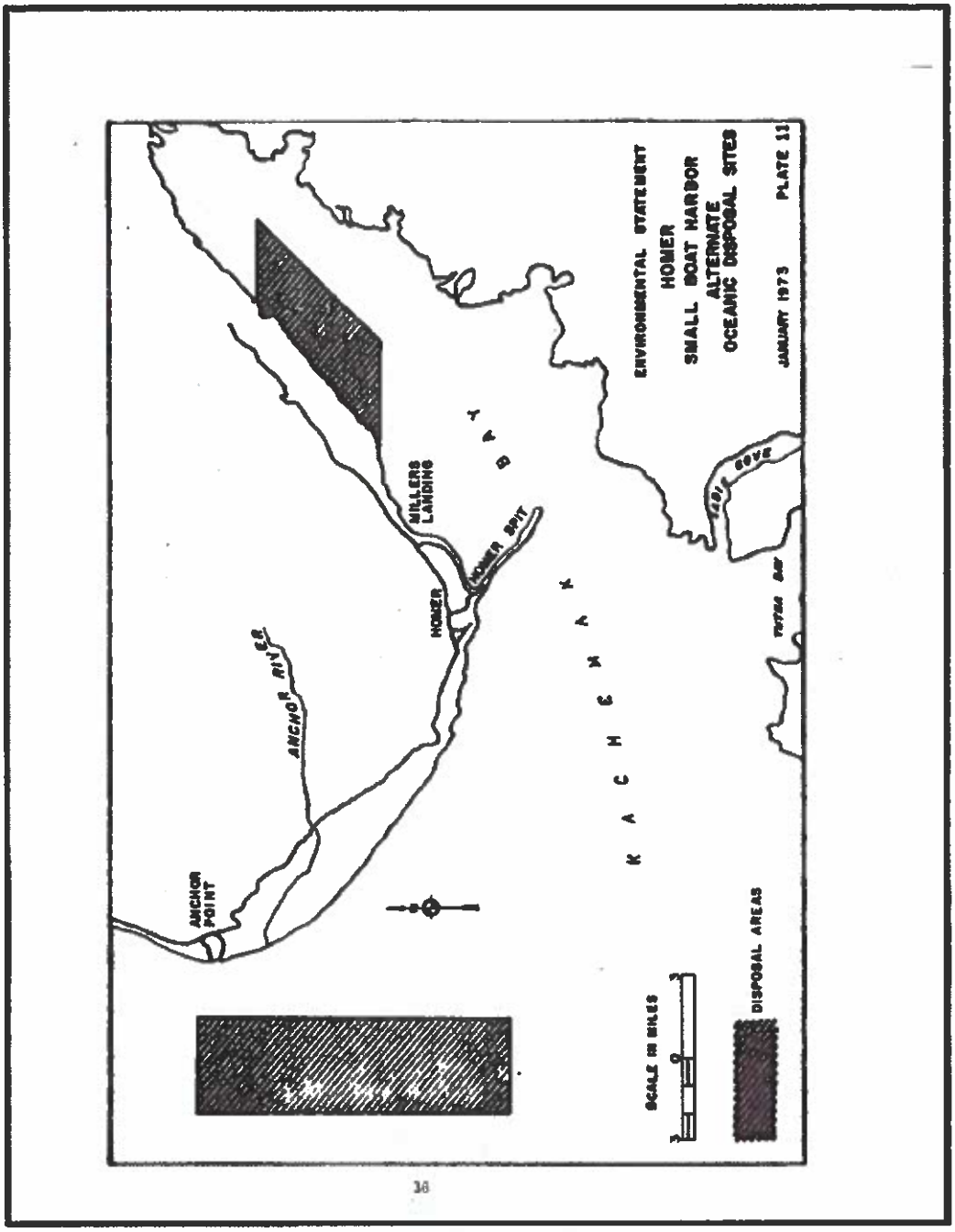

Figure 3. Homer Small Boat Harbor offshore dredged material disposal sites historically considered by the U.S. Army Corps of Engineers, Alaska District (USACE, 1974).

Table 3. Cubic yards of material dredged from the Homer Small Boat Harbor entrance channel and the U.S. Coast Guard berthing area from 1993 through 2016.

Year	Entrance Channel (yd^3)	Coast Guard (yd^3)	Total (yd^3)
1993	6,000	2,700	8,700
1994	8,000	2,600	10,600
1995	8,700	2,600	11,300
1996	7,600	3,000	10,600
1997	6,100	2,100	8,200
1998	6,000	2,100	8,100
1999	7,500	3,000	10,500
2000	7,500	3,000	10,500
2001	5,000	Not dredged	5,000
2002	2,100	Not dredged	2,100
2003	4,400	1,938	6,300
2004	7,800	10,800	18,600
2005	8,500	6,105	14,605
2006	5,000	8,272	13,272
2007	8,500	8,000	16,500
2008	4,386	6,254	10,640
2009	Not dredged	7,368	7,368
2010	8,600	9,650	18,250
2011	4,250	1,177	5,427
2012	4,662	5,808	10,470
2013	1,381	6,261	7,642
2014	6,205	6,363	12,564
2015	1,665	3,658	5,323
2016	2,503	7,232	9,735
Average	**5,515**	**4,582**	**10,096**

Source: U.S. Army Corps of Engineers, Alaska District and U.S. Coast Guard project files.

The Corps has historically dredged using a hydraulic cutterhead dredge because of its affordability and flexibility to reach all areas of the harbor. However, due to the lack of a dewatering site in 2009, the USCG used a clamshell dredge three times at its berth, loading material into trucks and transporting the material to a stockpile area on the Spit. This scenario resulted in a cost four times the usual amount to recover less than half of the material normally dredged with a hydraulic dredge. Because the clamshell dredge had a limited reach, some portions of the berth remained shoaled.

The 1964 earthquake caused the Spit to subside significantly and shorelines to erode. Subsequently, the City of Homer began playing a pivotal role in how dredged material from the harbor or any area on the Spit was to be handled. In 1965, the City of Homer passed an ordinance (No. 6-720.2) to protect and preserve the stability of the highly erodible Spit and its other land areas within the corporate limits. The ordinance specified that, "*The removal or excavation of gravel, gravel fill or fill material from any beach or from any portion of the Homer Spit shall be regulated by the City of Homer.*" (Appendix B). The State of Alaska, pursuant to formulated guidelines, require permits: (1) whenever gravel or other material is to be removed from the Spit or from beaches elsewhere within the city corporate limits, and (2) whenever such materials are removed or excavated from any naturally created berm area, or from any berm area created for the protection of land areas. In 1977, the City obtained from the State of Alaska, tidelands (defined as those lands seaward of the mean high tide line and "*Director Line*") along the City limits, including those along the Spit (Appendix B).

In 1998 the City of Homer passed Ordinance 98-2(A)(S)(A) amending City Code Section 19.12.050 entitled "*Exceptions regarding excavation of Homer Spit Beach*" which allowed certain types of excavation work to proceed on the Spit without a need for a permit, provided no excavated material left the construction site (Appendix B). The ordinance specified that no permit would be issued that would allow gravel, gravel fill or other fill materials to be taken off the Spit, and that any such material excavated anywhere on the Spit would be used only at another location on the Spit.

Because of isostatic rebound from the 1964 earthquake and normal coastal sedimentary transport mechanisms, the Spit's elevation has increased and the need for restricting the fate of material dredged from the Spit has lessened. To proactively address the possibility of not having areas on the Spit to stockpile an anticipated overly abundant supply of dredged material, the City of Homer began seeking ways to beneficially use the stockpiled dredged material on the Spit for beach nourishment and constructing additional parking areas on the Spit. In 2011, the City of Homer passed Ordinance 11-09 (Appendix B), amending Homer City Code 19.12.050 (Exceptions), providing for the use and disposal of dredged material in the following order of priority:

1. Replacement of material removed from City beaches by storms or erosion.
2. Fill to improve City port and harbor facilities on the Spit.
3. Sale for use as fill on privately owned or leased property on the Spit.
4. Emergency repairs of Spit erosion.
5. Sale for use as fill material at locations off the Spit.

2.2 Existing Maintenance Dredging and Disposal Operations

2.2.1 Dredging and Dewatering

Currently, a cutterhead suction dredge, using a hydraulic pipeline, dredges the Homer SBH and USCG berth in September and the USCG berthing area again in April (Figure 4). Occasionally, the USCG uses a clamshell dredge during the winter to achieve its project depth at its berth.

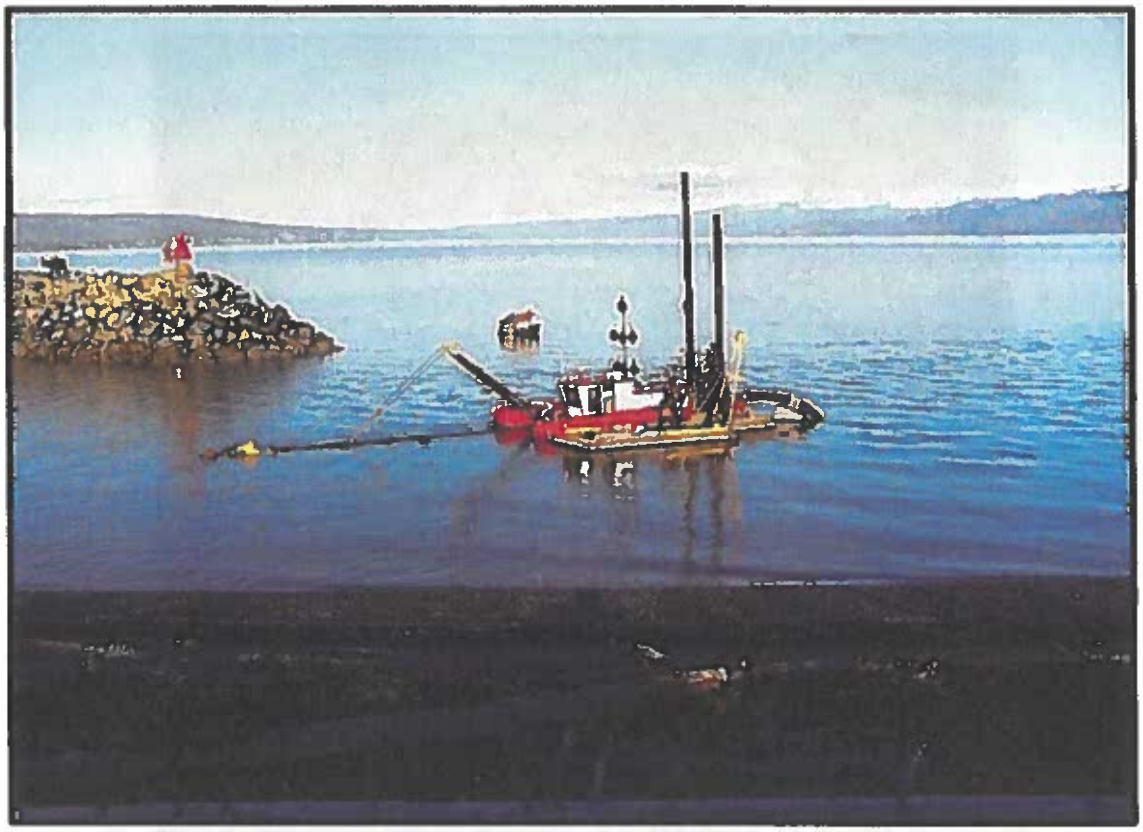

Figure 4. Hydraulic pipeline cutterhead suction dredge, Homer Spit, Alaska

Dredged material is pumped through a portable pipeline from the floating dredge plant to a bermed, triangular-shaped 49,200-square-foot dewatering site on a parcel of city-owned land near the entrance channel (Figure 5). The dredge pumps about 12 cubic feet per second of slurry composed of water and sediment typically containing about 62 percent gravel, 36 percent sand, and 2 percent fines, for up to about 24 hours daily. Effluent from the dewatering site drains through pipes connected to a manifold at the dewatering site. The effluent flows through the pipes, diffused to mitigate erosion, and discharged on the beach (Figure 6).

2.2.2 Disposal Site

Presently, the City of Homer has designated only one stockpile site for the dewatered material dredged from the Homer SBH and USCG berthing area: a 1.83-acre site just north of the existing harbor at the corner of Freight Dock Road and Homer Spit Road (Figure 7). The capacity of the site is approximately 45,000 cy. Averaging 10,096 cy dredged per year (Table 3), the project life of the site is 4 years. However, to date the stockpile site has not reached capacity because the City of Homer periodically sells material from the site or directly from the dewatering site, in addition to using it beneficially for projects on the spit in accordance with Ordinance 11-09.

Figure 5. Hydraulic pipeline discharging dredged material into dewatering basin, Homer Spit, Alaska

Figure 6. Pipelines from dewatering site leading to beach discharge site, Homer Spit, Alaska

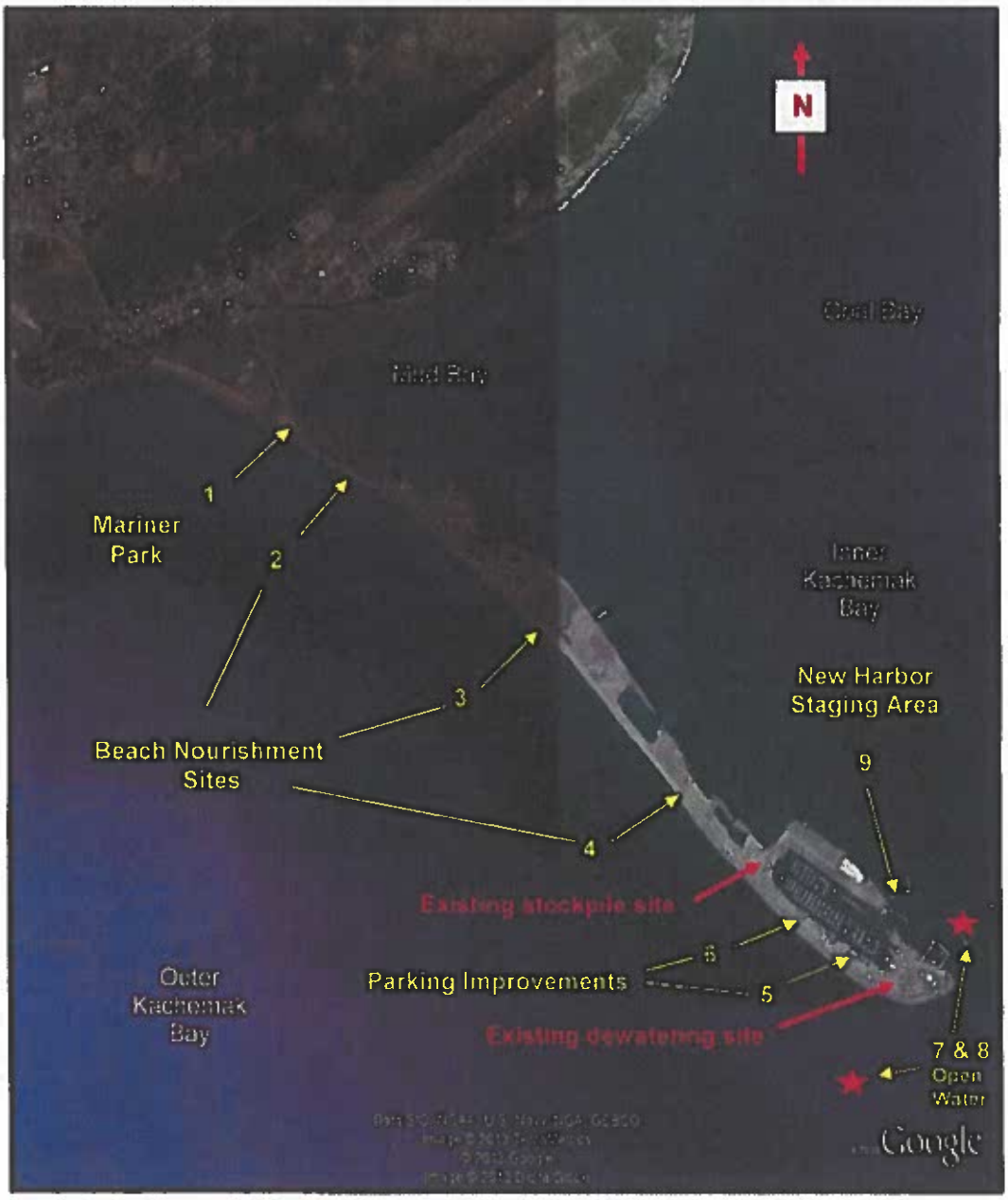

Figure 7. Location of existing dredged material management sites and the nine sites being considered as additional dredged material management sites, Homer Spit, Alaska

3.0 DESCRIPTION OF POTENTIAL DREDGED MATERIAL MANAGEMENT SITES ON HOMER SPIT

Nine sites on and around the Spit were identified after considering: (1) the material-use priorities established by the City of Homer; (2) the goals and objectives of the Homer Spit Comprehensive Plan; (3) Corps' Civil Works authorities, policies, guidelines and previous studies and environmental documents; and (4) the problems associated with the existing dredged material dewatering and stockpile sites. All nine sites under consideration are either on and/or adjacent to the Spit and are associated with beach nourishment (Sites 2, 3 and 4), parking pad development (Sites 1, 5 and 6), improving port and harbor facilities (Site 9), or offshore disposal (Sites 7 and 8) (Figure 7).

The sections that follow describe the physical surroundings and summarize the biological features of the sites being considered for dredged material management. Appendix A should be referenced for more detailed textual and photographic descriptions of the terrestrial/marine habitat associated with each site.

3.1 Existing Dredged Material Stockpile Site: North of Harbor Basin

3.1.1 Physical Surroundings and Features

This city-owned 1.2-acre stockpile site is surrounded by harbor access roads and existing commercial establishments and is not structurally separated from public access (Figure 8 and Figure 5 in Appendix A). A public campground is west of the site and to the east are various vendors, parking areas, and areas designated by the City of Homer for future commercial development. The material stockpiled from the dewatering site is a mixture of course sand, gravel, and small stone and cobble (Figure 9).

3.1.2 Biological Features

The stockpile area has few biological features to describe because of its "transitory" characteristics. The periodic stockpiling and removal of dredged material using dump trucks and frontend loaders heavily disturb the piles, not affording much time for vegetation to reestablish and become habitat for wildlife; however, the "older" undisturbed piles of dredged material have become revegetated with beach rye grass and assorted invasive plant species. The only wildlife known to inhabit the stockpile area occasionally are gulls, ravens and bald eagles that rest on top of the piles.

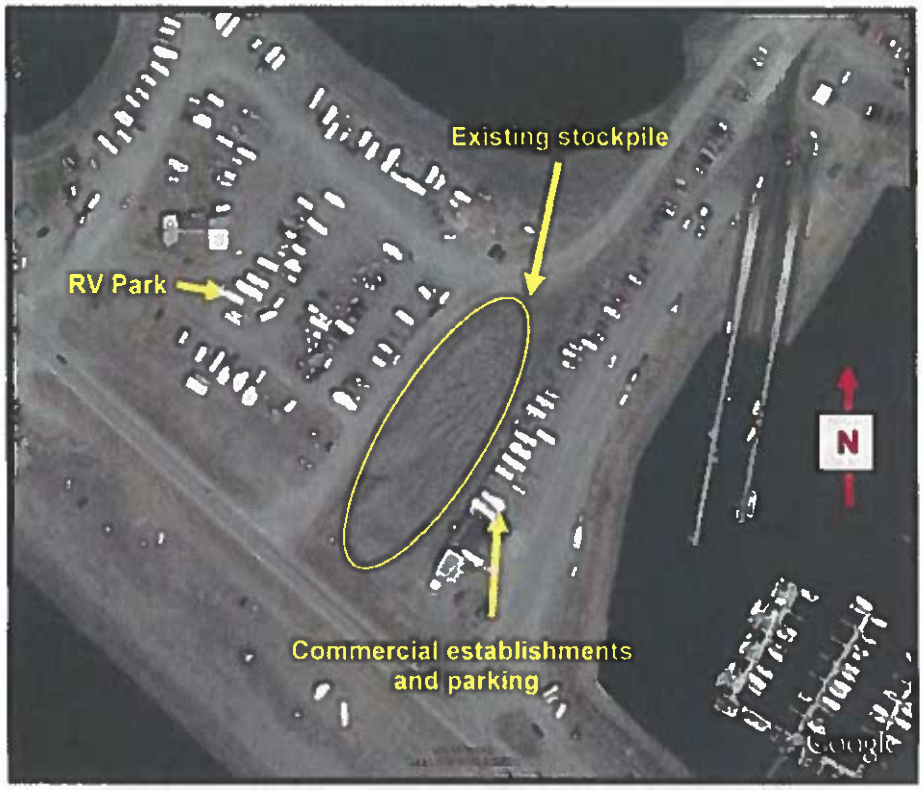

Figure 8. Existing dredged material stockpile area, Homer Spit, Alaska

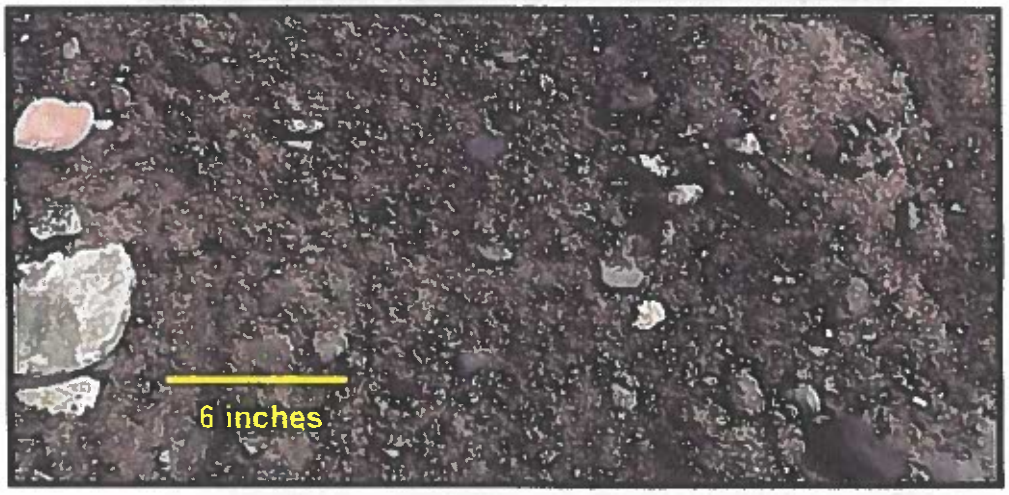

Figure 9. Dredged material composition of sand, gravel and small cobble obtained from dredging the Homer SBH.

3.2 Beach Nourishment Sites

The three areas (BN 1, BN 2, BN 3) on the Spit are candidates for beach nourishment because of their: (1) association with shoreline areas documented to be prone to erosion, and (2) proximity to existing engineered shoreline protection features (Figure 10). A summary of the Spit's history of shoreline erosion problems and the engineering attempts to solve them is contained in Appendix C.

Figure 10. Three potential beach nourishment sites for receiving material dredged from the Homer SBH and U.S. Coast Guard dock.

3.2.1 Beach Nourishment Site BN 1

3.2.1.1 Physical Surroundings and Features

This area extends approximately 2,900 feet southeast along shore from Mariner Park and adjacent to a rock revetment (Figure 10). The rock revetment protects the inshore half of the Homer Spit Road from erosion. An expansive sandy/muddy tidal flat extends just offshore and is pocketed with tidal drainages and tide pools. Also along this stretch and extending offshore are a series of dilapidated wood pilings historically associated with groins constructed in an attempt to control shoreline erosion (Figure 11, Figure 9 in Appendix A, Appendix C).

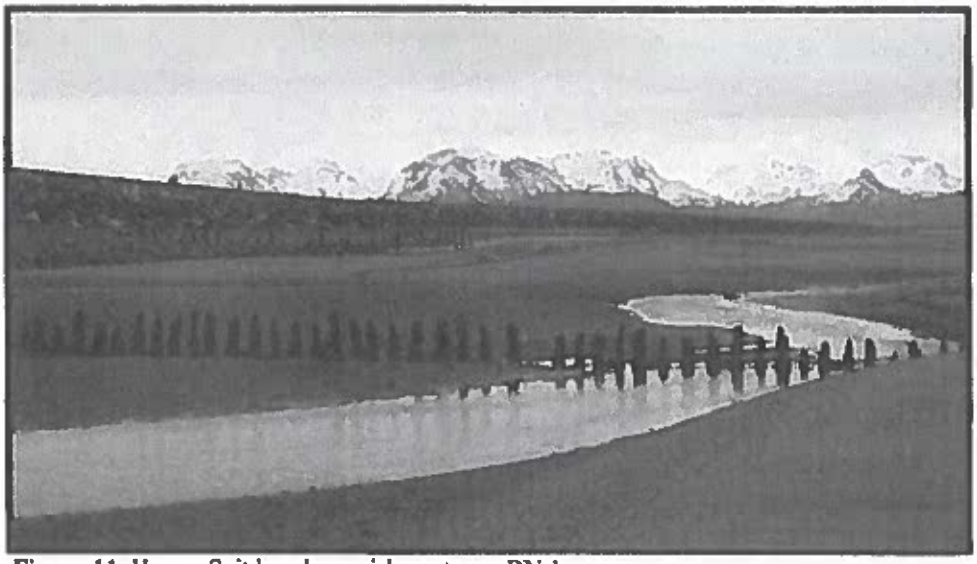

Figure 11. Homer Spit beach nourishment area BN 1.
This photo illustrates two locations of historically constructed wood piling groins and expansive tidal flats features. View is southeast towards the end of the Homer Spit.

3.2.1.2 Biological Features

Three intertidal transects (BN 1-1, BN 1-2, BN 1-3) were established to characterize the site (Figure 10 in Appendix A). Biologically diverse areas were found to be associated with the rocky habitat in tide pools and tidal drainages that pocketed an otherwise vast area of sandy/muddy tide flats devoid of epifauna and infauna (Figure 12).

With the exception of the intertidal area offshore from Mariner Park, a mix band of boulders and cobbles exists between 50 and 100 feet from the toe of the bordering rock revetment. These "rocky" bands were often associated with pooled areas and heavily encrusted with barnacles, algae, and various species of epifauna (mussels, sponges, limpets, etc.) (Figures 12 and 13 in Appendix A). Beyond 100 feet from shore the terrain elevates on to a sandy tidal flat before dropping back into a rocky-substrate tidal drainage/tide pool that appears to be more species-rich than the closer-to-shore pooled areas (Figure 15 in Appendix A). No tide pools or rocky benthic habitat were observed beyond approximately 540 feet from shore, as in this area only sandbars exist. (Figure 16 in Appendix A).

The benthic habitat offshore from Mariner Park was very different from the other areas investigated. The intertidal substrate between 0 to 300 feet from shore was a mix of course sand, pebbles, cobble, and occasional boulders with no evidence of epifauna or infauna (Figure 13). The sandy tide flats/sandbars beyond 300 feet to approximately 500 feet were also devoid of marine organisms. Between 550 and 600 feet, however, the substrate mix of cobble/pebble within a tidal drainage had barnacles, amphipods and a large amount of algal detritus (Figure 19 in Appendix A).

Figure 12. Typical intertidal habitat at BN 1 illustrating both vast tide flats and rocky substrate.

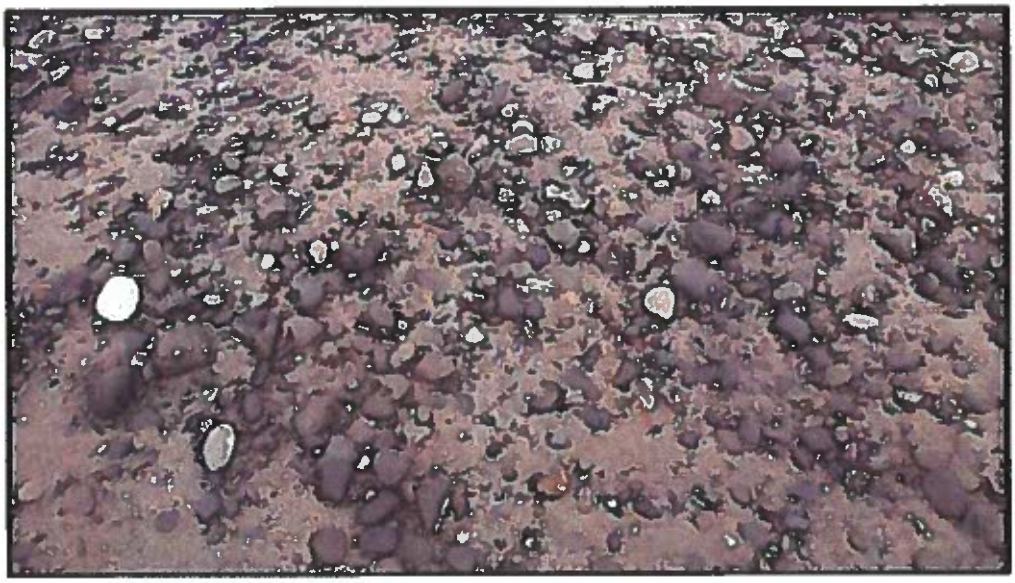

Figure 13. Benthic habitat substrate offshore from Mariner Park in BN 1.

3.2.2 Beach Nourishment Site BN 2

3.2.2.1 Physical Surroundings and Features

This area extends approximately 1,400 feet along a rock revetment on the west side of the Spit (Figures 10 and 14 and Figure 21 in Appendix A). The Corps constructed the 1,130-foot-long rock revetment in 1994 to protect a 1,040-foot-long cantilevered steel sheet pile wall constructed

Figure 14. BN 2 physical setting adjacent to rock revetment protecting Homer Spit Road.

by the State of Alaska in 1980 and subsequently repaired in 1982 after a storm surge event overtopped it (Figure 22 in Appendix A, Appendix C).

3.2.2.2 Biological Features

Because of the uniform terrain alongshore and offshore from the toe of the rock revetment, only one 600-foot-long transect (BN 2-1) was necessary to characterize the entire area's intertidal community of organisms and substrate (Figures 14 and 15).

The entire benthic substrate, from the toe of the revetment to approximately 290 feet from shore, is composed of a gravel mix of pebbles, cobble and boulders. The first downward-sloping 35 feet is clean gravel without any epifauna and infauna. Beyond 35 feet a 40-foot-wide band of cobble substrate exists that is uniformly covered with silt and a non-filamentous green algae that casts a green hue (Figure 24 in Appendix A). Amphipods were the predominant invertebrate found beneath the cobble substrate. Also scattered within this offshore substrate were tide pools about 1 foot deep, each having an established brown and green algae community (*Fucus* sp., *Ulva* sp., ribbon kelp, etc.) as well as being inhabited by blue mussels, acorn barnacles, amphipods, and sponges (Figure 16 and Appendix A - Figures 25 and 26).

Seaward of the band of tide pools, the cobble substrate slopes towards a tidal drainage channel. The same type of assemblage of organisms, as in the neighboring tide pool, inhabits this area except that the area has a more dense barnacle and polychaete worm population along with shell debris and filamentous green algae. The cobble substrate ends at the edge of a tidal drainage channel, which flows southeast towards the end of the Spit (Figures 28 in Appendix A). On the other side of the drainage channel a sand bar/mud flat extends out into the water. At low tide, the algal detritus covered sand bar is devoid of epifauna, but has a limited infauna community of polychaete worms. (Figure 29 in Appendix A).

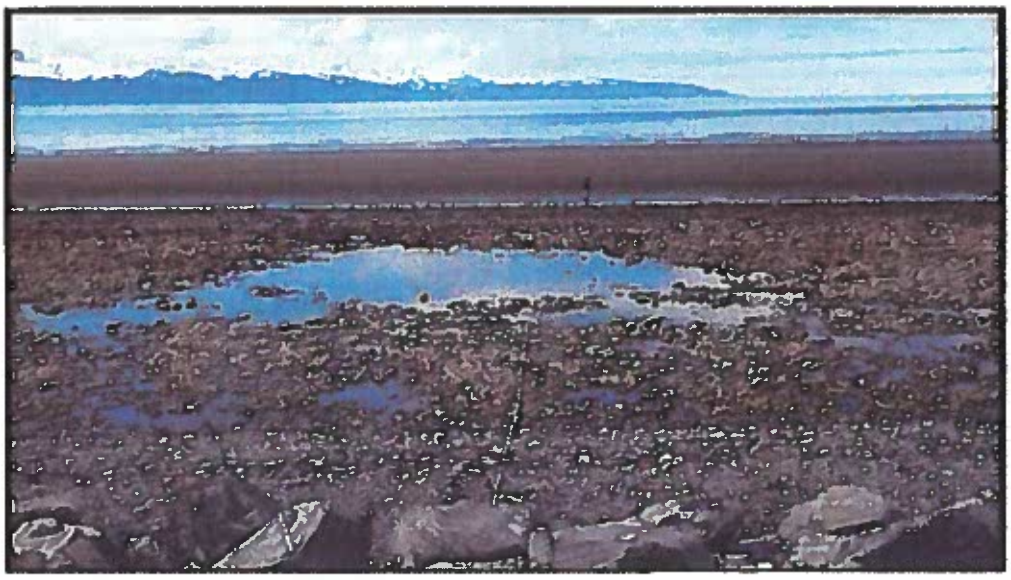

Figure 15. BN 2's intertidal characteristics showing rocky tide pools, tidal drainage and sandy tidal flats.

Figure 16. Homer Spit beach nourishment area BN 2, epi/infauna assemblage in tide pools.

3.2.3 Beach Nourishment Site BN 3

3.2.3.1 Physical Surroundings and Features

This area extends approximately 550 feet along the outer Kachemak Bay shoreline of the Spit, opposite the Heritage RV Park (Figure 10). The site begins near the southern end of a 3,700-foot-long rock revetment and 500-foot-long rock transition area the Corps constructed in 1998 (Appendix C) and ends in an area of shoreline without any constructed shoreline protection measures (Figure 17). From this location and extending to the end of the Spit, the beaches are wide enough to allow recreational camping and RV parking along the shoreline

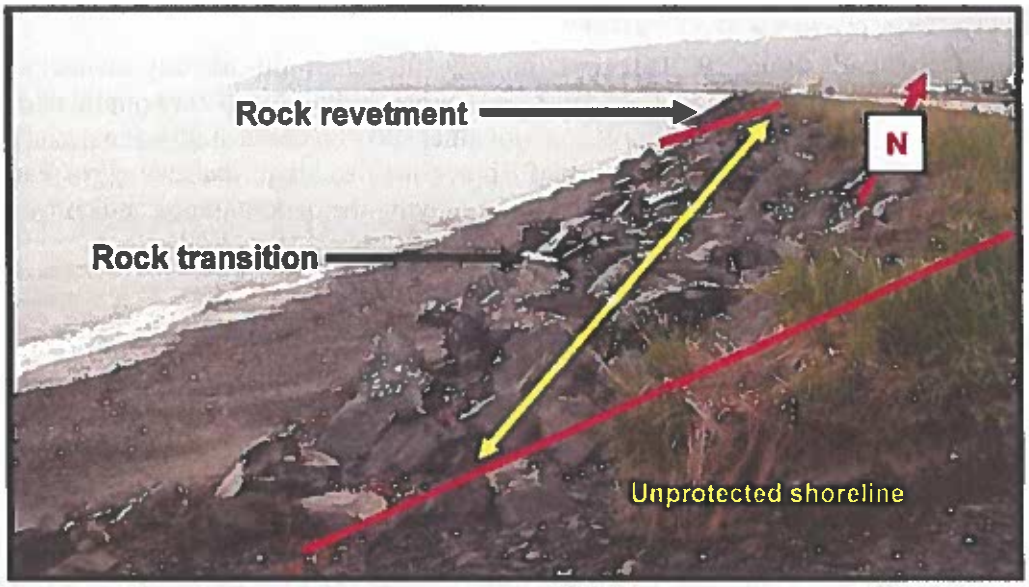

Figure 17. Homer Spit beach nourishment area BN 3 showing orientation of rock revetment and transition.[1]

(Figure 31 in Appendix A). At the top of the State of Alaska rock revetment is an eroding shoulder of the Homer Spit Road. Other areas at the top of the revetment are also slumping, causing clumps of grassy vegetation to erode on to the beach (Figures 32 and 33 in Appendix A).

3.2.3.2 Biological Features

No epi- or infauna organisms exist within the footprint of the nourishment area, which is primarily at the base of the existing rock revetment and along the unprotected shoreline just to the south of the revetment (Figures 31 and 34 in Appendix A). Historical photographs helped determine what benthic communities might exist just offshore from this site. It appears that alongshore movement of bottom sediment periodically covers and then exposes bands of cobble/gravel habitat, which likely support similar benthic communities found in the other beach nourishment sites; however, the predominant nearshore benthic habitat appears to be sand bars and mud flats devoid of an established epifauna community (Figures 36 and 37 in Appendix A).

3.3 Parking Pad Development Sites

Dredged material would be used to construct two parking pads on the Spit near the boat harbor and to improve an existing parking lot at Mariner Park (Figure 7).

[1] In 2015, the ADOT/PF added quarry rock on the top of a 4,175-foot-long stretch of the existing rock revetment to protect Homer Spit Road from coastal erosion processes and storm events.

3.3.1 Mariner Park

3.3.1.1 Physical Surroundings and Features

Located on the north end of the Spit, this approximately 100-acre multi-use, city-owned park is a popular camping spot that attracts local residents and tourists alike. The 3- acre public parking and camping area, above +23.4 feet MLLW, is a potential site to receive dredged material (Figure 18, Figure 6 in Appendix A). The City of Homer has also identified several recreational and safety enhancement projects for the park, such as moving the park entrance and constructing permanent restrooms.

Figure 18. Northwest view of Mariner Park parking area, Homer Spit, Alaska.

3.3.1.2 Biological Features

Adjacent to Mariner Park is Mud Bay and Mariner Lagoon, both of which are parts of the Western Hemisphere Shorebird Reserve Network in the State of Alaska Kachemak Bay Critical Habitat Area (CHA). Because of its heavy recreational and vehicle use, the park's footprint itself lacks quality wildlife habitat; however, shorebirds heavily use the offshore areas for feeding. Beach-berm-associated vegetation surrounds the area except on its Cook Inlet side, where only scattered patches of vegetation exist because of heavy human use to access the shoreline and offshore tidal flats and sand bars. The only wildlife observed using the upland vegetated areas were passerine birds and shorebirds flying through the area.

3.3.2 Parking Pad 1

3.3.2.1 Physical Surroundings and Features

The approximately 350-foot-long by 60-foot- wide parking pad would be constructed in a low-lying area surrounded by an existing parking lot to the east along the Homer Spit Road, an existing parking lot to the southeast, an accumulation of pile-supported commercial establishments to the northwest, and by a vegetated storm berm to the west (Figures 7, 19 and

20). Immediately across the Homer Spit Road from this site are the Homer SBH, parking lots, and commercial developments. The existing parking areas adjacent to the site were constructed using gravel fill material of unknown origin.

Figure 19. Parking pad development Site #1 on Homer Spit, Alaska.

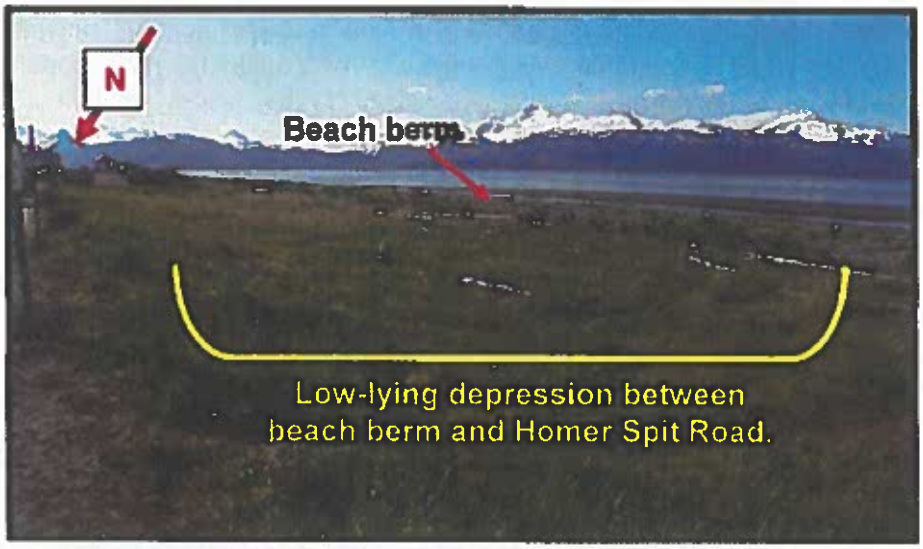

Figure 20. Parking pad development Site #1 on Homer Spit, Alaska.

3.3.2.2 Biological Features

The existing substrate is primarily beach gravel covered with a thin sandy/vegetated mat. The vegetation community is predominantly sand/wild rye grass, scattered with patches of leafy vegetation including seabeach senecio, beach pea, Arnica, scurvy weed, and seacoast angelica (Figures 41 thru 43 in Appendix A). No wildlife was observed using the area during a Corps site visit. No intertidal transect information was collected at this site because the area proposed for parking pad development is not expected to extend below the mean high tide line (+23.4 ft. MLLW).

3.3.3 Parking Pad 2

3.3.3.1 Physical Surroundings and Features

This approximately 5.5-acre area extends approximately 900 feet between pile-supported commercial developments to the southeast and northwest and west adjacent to the Homer Spit Road (Figures 7 and 21). The parking pad's width would extend seaward approximately 90 feet from the edge of the Homer Spit Road, and lies in a depression between the road and a vegetated storm berm. Except for the seaward shoreline of the area, the entire area is surrounded by harbor-related commercial developments and parking areas.

3.3.3.2 Biological Features

The substrate shoreward from a storm-generated beach berm at the extreme high water line (+24.8 ft. MLLW) and within the parameter of the parking pad is primarily beach gravel covered with patches of vegetation (Figure 22). Vegetation is predominantly wild rye grass with patches of leafy vegetation including sea sandwort, seabeach senecio, beach pea, Arnica, scurvy weed, sea bluebell, and seacoast angelica (Figures 47 and 48 in Appendix A). No wildlife was observed using the area during a Corps site visit.

3.4 Improving Port and Harbor Facilities Site: New Staging Area

In March 2007, the Corps, City of Homer, and State of Alaska Department of Transportation and Public Facilities (ADOT/PF) entered into an agreement to investigate the navigational needs of the Homer SBH. The investigation was necessary because: (1) the existing small boat harbor is utilized beyond its capacity and is unable to accommodate the needs of larger commercial fishing vessels; (2) overcrowding in the harbor is also a problem for smaller commercial fishing, charter, and recreational vessels; and (3) vessel operators have indicated they would relocate their permanent moorage to the Homer SBH if moorage space was available. A number of investigated solutions (i.e. alternatives) were considered. One alternative was associated with the City of Homer's desire to construct an additional harbor (mooring basin, entrance channel, breakwaters, boat ramp, staging area, etc.) on the Inner Kachemak Bay side of the Spit, adjacent to the existing small boat harbor (Figure 23). If constructed, the new harbor's staging area would use fill material generated by dredging the new harbor's mooring basin. However, the new harbor alternative was dropped from consideration because a Corps analysis of its potential construction costs and economic benefits in 2007 concluded that it was not economically justified, but an up-to-date analysis might conclude otherwise. For that reason and the City of Homer's desire for more commercial-use upland, the Corps chose to include the potential new staging area in its dredged material management strategy investigation.

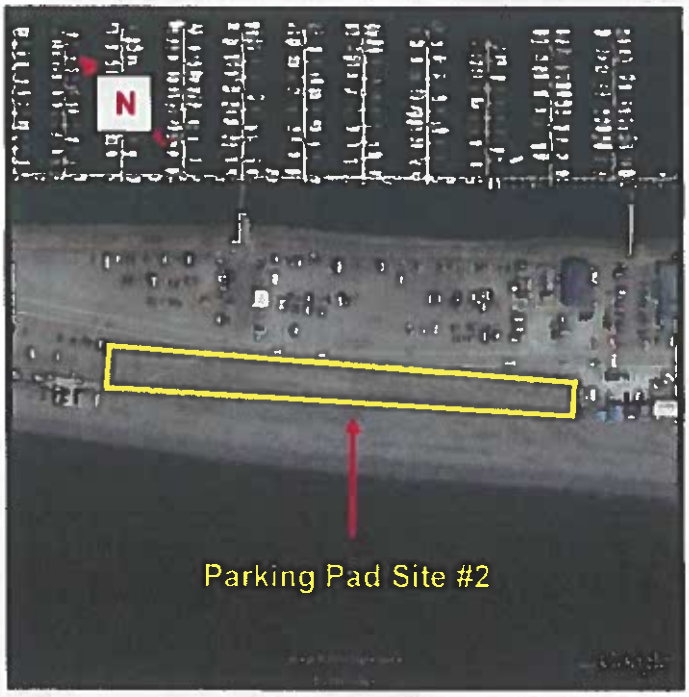

Figure 21. Parking pad development Site #2 on Homer Spit, Alaska.

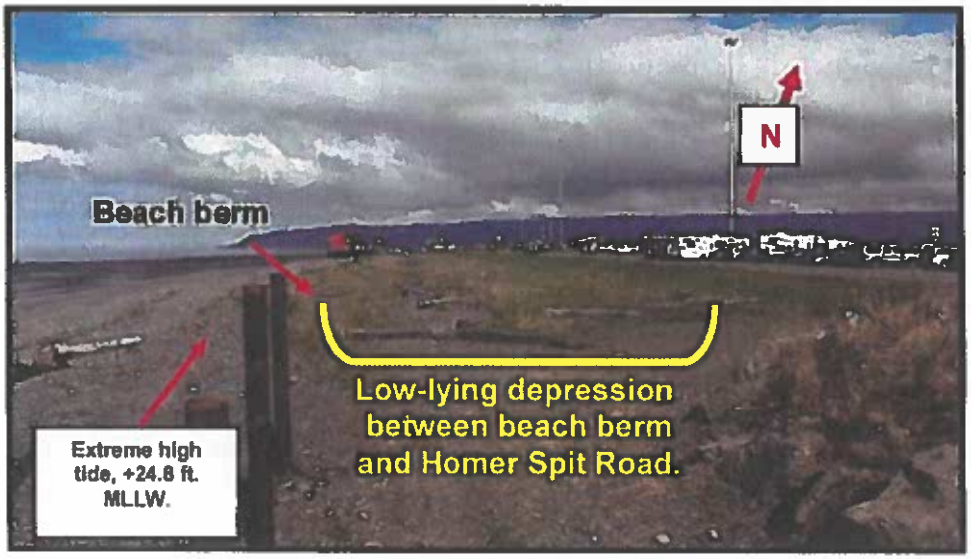

Figure 22. Parking pad development Site #2 on Homer Spit, Alaska.

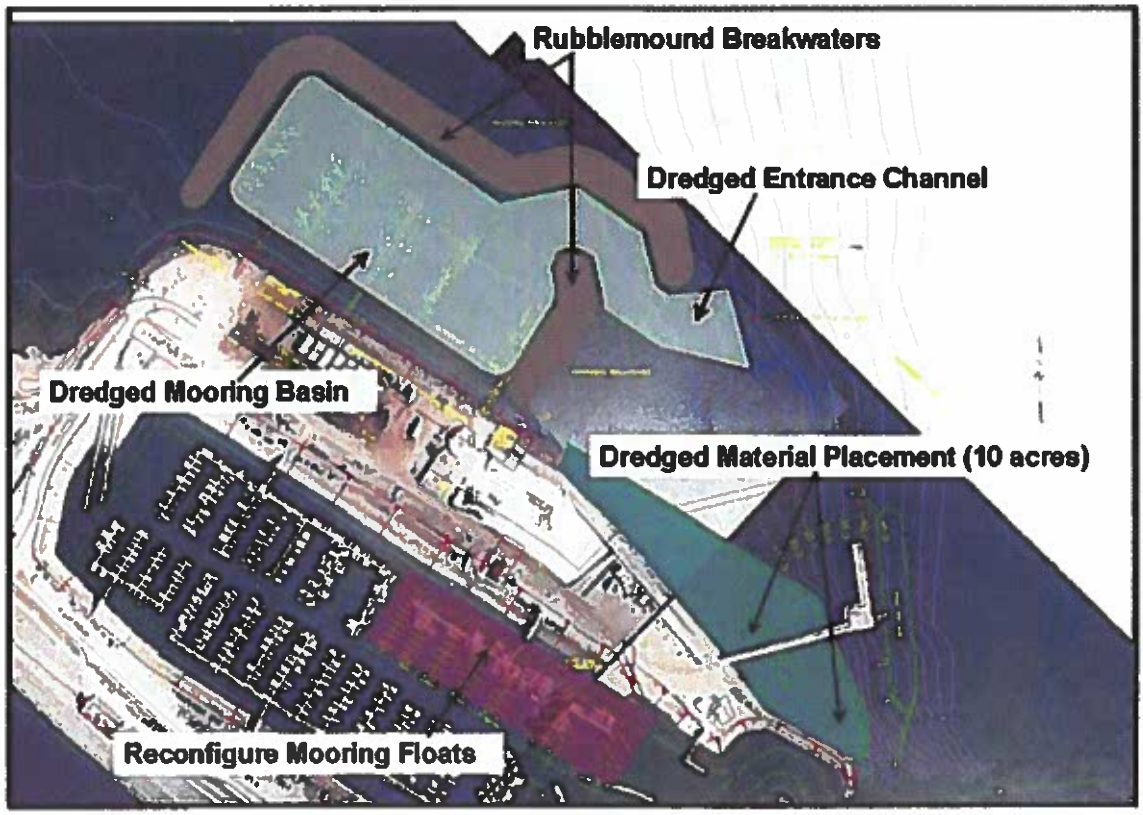

Figure 23. Conceptual location of a potential new boat harbor's 10-acre staging area, Homer Spit, Alaska.

Note to reader: Figure 23 represents an earlier conceptual harbor design that the City of Homer has recently updated to accommodate deep-water draft vessels and associated industrial development.

3.4.1 Physical Surroundings and Features

This potential disposal site is associated with the City of Homer's desire to create about 9 acres of commercial property next to the existing Homer SBH and potential new small boat harbor. Material maintenance dredged from the existing small boat harbor and USCG berthing area, and new dredged material from the potential new harbor, would be placed within a confined area, and when filled to capacity, the area would function as the desired commercial property. The existing shoreline consists of stone riprap (Figure 59 in Appendix A) for storm protection, and the adjacent upland was constructed using dredged material from the harbor's previous expansion projects. The adjacent land use is designated in the HSCP as industrial and associated with a deep-water dock, which extends offshore from the immediate area (Figure 60 in Appendix A and its cover page).

3.4.2 Biological Features

After conducting a reconnaissance survey of the area, three intertidal transects (NHSA 1, NHSA 2, and NHSA 3) were positioned so that the maximum amount of biological information could be collected (Figure 61 in Appendix A). It was evident that the intertidal habitat on the inside (i.e. Inner Kachemak Bay) end of the Spit was drastically different from that found on the outside (i.e. Outer Kachemak Bay) of the Spit. The protective waters and rocky substrate found along the inside end the Spit provide a "stable" environment for the establishment of a species-rich and diverse intertidal community (Figure 24).

Figure 24. Intertidal area in the protected waters of Inner Kachemak Bay.
This area is proposed as a potential staging area for the Homer Small Boat Harbor, Homer Spit, Alaska.

The entire intertidal area northeast of the deep-water dock, and adjacent to the riprap protecting the eastern shoreline of the Spit, is heavily vegetated with kelp and other brown and green algae that support a diverse assemblage of marine organisms. The area is very flat and sandy and, at low tide, is scattered with boulder and cobble patches (Figures 62 and 63 in Appendix A). The rocky substrate is heavily covered with *Laminaria* sp., ribbon kelp, and the green algae *Ulva* sp. (Figure 25). Beneath the kelp cover, worm casings, red algae (albeit not identified), and bryophytes encrust the rocky surfaces (Figures 64 and 65 in Appendix A). Rock crevices were commonly inhabited with a variety of sea stars (*Pisaster* sp., *Evasterias* sp.), sea anemones, crustaceans, sea urchins, limpets, snails, and other epifauna (Figures 26 and 27). The boulder patches sit on a hard-packed sandy substrate that has an infauna community composed primarily of polychaete worms and to a lesser extent, bivalves. Small-scattered patches of eelgrass were located near the toe of the rock riprap (Figure 28).

Figure 25. Benthic substrate heavily covered with kelp at potential new staging area, Homer Spit, Alaska

Figure 26. Intertidal area inhabited with starfish at the potential new staging area, Homer Spit, Alaska

Figure 27. Christmas anemone surrounded by green algae and kelp, inhabiting the intertidal area within the potential new staging area, Homer Spit, Alaska

Figure 28. Intertidal eelgrass bed within the potential new staging area, Homer Spit, Alaska

3.5 Open water Disposal Sites

Two open water sites off the tip of the Spit in Kachemak Bay are candidates for open water disposal (Figure 29). The Corps assumes that a hydraulic cutter-head suction dredge would pump dredged material as slurry through a pipeline and directly discharge it through the end of the pipe into offshore waters; however, other mechanical means and methods of dredging and disposal could be chosen and implemented.

3.5.1 Outer Kachemak Bay: Physical Surroundings and Biological Features

This 3-acre open water disposal site lies off Archimandritof Shoals in water depths ranging from 60 to 130 feet (Figure 29 and Figure 53 in Appendix A). Attempts to obtain substrate samples using a clamshell bottom sampler proved difficult because of swift subsurface currents and the compact/dense nature of the substrate. The one bottom sample successfully obtained was composed of very fine sand and small coal fragments and was devoid of epi-and infauna (Figure 54 in Appendix A).

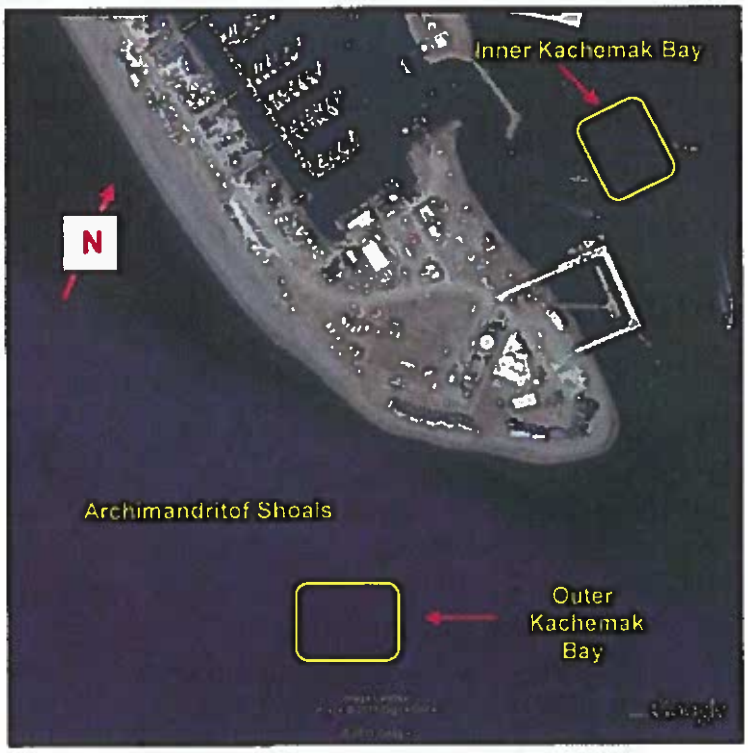

Figure 29. Relative location of the two proposed open water dredged material disposal sites, Homer Spit, Alaska

3.5.2 Inner Kachemak Bay: Physical Surroundings and Biological Features

This approximately 3-acre site is just outside of the Homer SBH entrance channel, in water depths ranging from 60 to 180 feet (Figure 29, Figure 56 in Appendix A). Attempts to video tape the disposal site's benthic habitat failed because of swift currents and vessels transiting in and out of the harbor. Bottom sampling at this location proved successful because the substrate was soft and easier to penetrate than at the Outer Kachemak Bay site. The bottom sample was

composed of silt and very fine sand; no epifauna was found, and the only infauna in the sediment were polychaete worms and their casings (Figure 30).

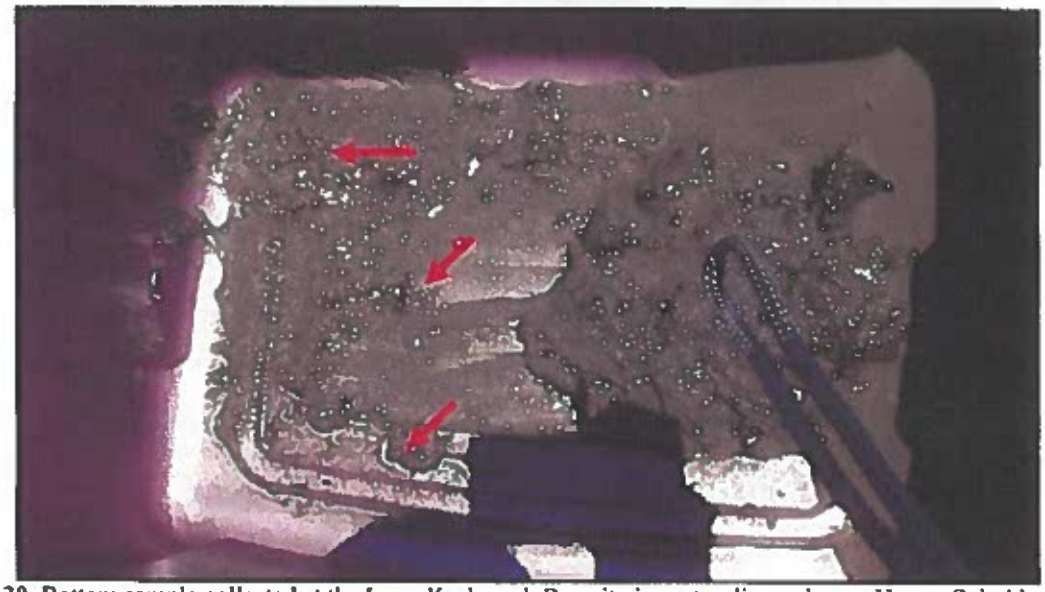

Figure 30. Bottom sample collected at the Inner Kachemak Bay site in-water disposal area, Homer Spit, Alaska
Note: red arrows indicate the presence of polychaete worms and/or casing.

3.6 Supplemenal Kachemak Bay Environmental Information

In 1974, the Alaska Legislature established the tidelands and submerged lands of Kachemak Bay as critical habitat to protect and preserve habitat especially crucial to the perpetuation of fish and wildlife (Figure 31). The "Kachemak Bay and Fox River Flats Critical Habitat Areas Management Plan (Kachemak Bay Plan)" was prepared to provide consistent long-range guidance to the Alaska Department of Fish and Game (ADFG) and other agencies involved in managing designated critical habitat areas (ADFG, 1993). Included within the Kachemak Bay Plan was a major inventory of the bay's fish and wildlife resources, including those resources in proximity to the Spit, as well as an exhaustive list of related cited literature. In 2014, however, the Alaska Legislature excluded from the Kachemak Bay CHA (via Senate Bill 148) all tidelands and submerged lands associated with the, "... *Homer port, harbor, and municipal lands immediately adjacent to port facilities necessary for port operations* ..." (Figure 32).

The Kachemak Bay Research Reserve (KBRR), designated in 1999 as part of the National Estuarine Research Reserve (NERR), integrates coastal and nearshore research and education at its headquarters in Homer, Alaska. As part of the NERR program, the KBRR published a thorough ecological characterization study that summarized the existing state of knowledge of Kachemak Bay research, monitoring, and education activities (KBRR, 2003). The KBRR also provides logistical support for area studies, e.g. Adams *et al.* (2007) and Ruggiero *et al.* (2007).

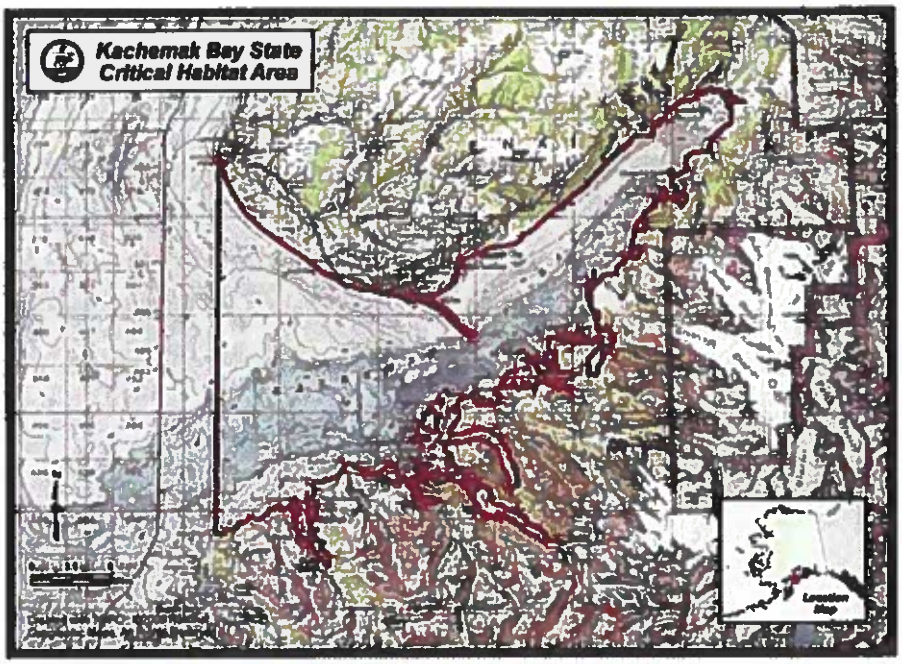

Figure 31. Boundary of the Kachemak Bay State Critical Habitat Area. Homer, Alaska.

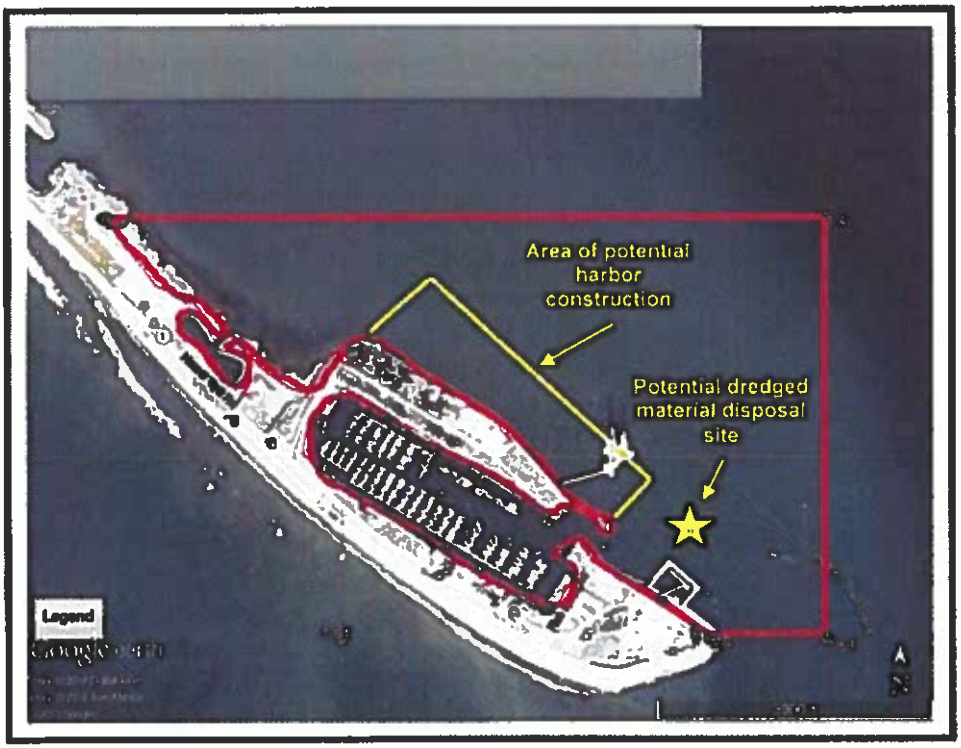

Figure 32. Port of Homer area (approximated) excluded from the Kachemak Bay State Critical Habitat Area. Homer, Alaska.

A variety of historical reports and documents has been produced describing Kachemak Bay's ecological environment in great detail. In 1972, the Corps produced an encyclopedic background study of Cook Inlet, including Kachemak Bay, which provided a basis for environmental impact statements relating to the exploration, development and production of petroleum in Cook Inlet (USACE, 1972). In May 1974, the Bureau of Land Management requested that the National Oceanic and Atmospheric Administration (NOAA) initiate a major environmental assessment program to establish an environmental baseline for detecting and assessing petroleum-related development impacts and to provide a basis for predicting the primary impact of that development on the Alaskan marine environment. A product of that effort was a 12-volume report providing background information on: (1) the Kachemak Bay environment, (2) the problems associated with petroleum development, and (3) the effects of oil pollution on the marine organisms and environment of Kachemak Bay (NOAA, 1977).

Lees *et al.* (1980) described the current state of knowledge at that time about the intertidal and shallow subtidal habitats in Lower Cook Inlet, and found that most of the information was included in NOAA reports associated with potential petroleum development and the effects of oil pollution. Lees and Houghton (1977) and Lees *et al.* (1981), who conducted intertidal transects in many of the same areas as in this Corps investigation, concluded that extensive cobble or clean sand areas on the west (exposed) side of the Spit are considered temporary habitats within areas of excessive sediment transport towards the end of the Spit. However, offshore cobble beds in water deeper than 15 feet on the west side of the Spit appear to be stable and permanent. Lees *et al.* (1981) and the Corps' investigation both determined that the infaunal assemblages are qualitatively and quantitatively different on the east and west side of the Spit, probably as a consequence of factors related to wave/storm exposure, i.e., the east side generally has higher numbers of species and individuals and greater species diversity and biomass than the west side. Environmental data around the Spit was also collected in concert with the Corps' Homer Spit beach erosion engineering studies (Appendix C), Homer Small Boat Harbor (SBH) navigation improvement studies (USACE, 1981), and the Homer SBH and USCG Dock dredged material management studies (USACE, 1974 and 2007).

Probably the most exhaustive amount of environmental information collected in Kachemak Bay occurred after the 1989 *Exxon Valdez* oil spill. Since 1991, the *Exxon Valdez* Oil Spill Trustee Council (http://www.evostc.state.ak.us/) and U.S. Geological Survey (http://pubs.er.usgs.gov/#home) have been funding numerous marine investigations in the Gulf of Alaska, including Lower Cook Inlet and Kachemak Bay.

4.0 DISCUSSION OF POTENTIAL ENVIRONMENTAL IMPACTS ASSOCIATED WITH DREGED MATERIAL MANAGEMENT OPTIONS

Provided in this section are: (1) an orientation of potential environmental issues associated with dredged material management options; (2) a summary of previous Homer SBH maintenance dredging environmental analyses; and (3) a cursory analysis of the potential environmental impacts associated with the Spit's dredged material management options.

4.1 Orientation of Potential Environmental Issues

Determining and assessing the potential impacts of placing dredged material in aquatic/marine environments involves multiple variables that cause the physical disruption of the bottom environment, the generation of suspended sediments, the possible release of contaminants, and the mortality and disruption of infauna and epifauna organisms inhabiting the area. Direct impacts are normally restricted to the immediate area of operation and include the immediate burial of organisms under various depths of dredged material. In some cases, however, dredged material can create a "higher quality" marine substrate not resembling the original "lower quality" substrate. Another variable to consider is how a particular disposal/placement method affects the environment, such as, barge-and-dump, pipeline discharge, trucked and stockpiled.

Aside from the physically disruptive effects, a long-term environmental concern is the recovery (repopulation) of bottom areas where dredged material is placed. Recovery can occur over periods of weeks, months, or years, depending on the type of environment and the biology of the organisms affected. Lateral migration of organisms and larval recruitment appear to be an important role in recolonization. Many species of motile, sediment-dwelling organisms are able to move vertically through dredged material, and laboratory tests have shown that when dredged material is physically similar to that in which organisms normally occurred, there was little problem in vertical mitigation (Hirsch, DiSalvo and Peddicord, 1978). Hirsch, DiSalvo and Peddicord (1978) report that the more naturally-variable the receiving environment, the less effect the dredged material will have, as organisms common to such areas can adapt to unstable sediment conditions and have life cycles which allow them to better withstand the stresses imposed by dredged material placement.

Sediment suspensions associated with placing dredged material in the marine environment unavoidably affects local benthic community functions such as photosynthesis, but the effects are transitory (Hirsch, DiSalvo and Peddicord, 1978). Depending on the physical characteristics of the dredged material, sediment suspension near the bottom known as fluid mud or flocculent layer formation is more environmentally damaging than the effects of normal turbidity (Hirsch, DiSalvo and Peddicord, 1978). Fluid muds present an extreme stress to bottom environments, as they are usually low in dissolved oxygen and persist for weeks or more before they sufficiently consolidate to provide a solid substrate for bottom organisms.

It is important to note that any open water disposal would have to consider potential impacts on State of Alaska-designated critical habitat within Kachemak Bay, as well as require plume modeling, sediment transport analyses, determination of the sediment's final fate and, if required, calculation of a mixing zone.

In summary, the ecological consequences of placing dredged material in aquatic/marine environments should be viewed along a continuum of severity, from adverse to beneficial, depending primarily on: (1) the amount and frequency of disposal; (2) the quality of dredged material (in terms of organic carbon content, degree of contamination, if any); and (3) the nature of the receiving environment and biological communities (Bolam, S.G. *et al*, 2006).

4.2 Summary of Previous Homer SBH Maintenance Dredging Environmental Analyses

Many of the issues identified in Section 4.1 have been analyzed for environmental issues in previous Corps projects involving Homer SBH dredging and dredged material management. The Corps' first detailed description of the potential impacts associated with managing dredged material from the Homer SBH occurred in a 1974 final operation and maintenance environmental impact statement (Final O&M EIS) (USACE, 1974). Up to that time, dredged material from the harbor was placed primarily in intertidal areas and in open water, but sometimes placed upland (Figure 2). The Final O&M EIS identified potential impacts to the marine and surrounding environment, such as: (1) the alteration of seabed habitat and loss of marine organisms; (2) the temporary increase in water turbidity; (3) the burial of intertidal habitat; (4) the temporary limitation of aesthetic value and recreational use; and (5) the disruption of littoral currents. The Final O&M EIS also considered using several disposal sites or methods, such as: (1) modifying the existing operation (e.g. using a hydraulic cutterhead dredge and pipeline to a disposal area and using trucks to haul the material); (2) using upland disposal sites (e.g. two city-identified depressions on the Homer Spit); and (3) using a previously used open water disposal site. Ultimately, the Final O&M EIS abandoned the open water disposal alternative and the Corps chose disposing dredge material intertidally and on uplands.

Under contract to the Corps, Dames & Moore prepared a report summarizing existing conditions at 18 Alaska harbor projects most likely to require maintenance dredging (Dames & Moore, 1977). Included was a chapter summarizing the Homer SBH's maintenance dredging history and associated environmental problems and/or special considerations. It was noted in the report that salmon smolt are abundant in Kachemak Bay during the late spring and early summer months, and it was suggested that dredging and especially disposal in intertidal and deep water sites should be scheduled to avoid the outmigration of salmon smolt. Furthermore, the report recognized: (1) Kachemak Bay's rich marine biota, and (2) the noted intertidal disposal area is not used by commercial fishermen or heavily used by sport fishermen (Figure 33). Suggested was placing dredged material intertidally to replenish beach sediments, as normal littoral drift would have naturally transported the materials to the disposal site in the absence of the harbor entrance. One recommended mitigation measure in the report was to prohibit placing dredged material below MLLW so that recreationally important clam beds would not be buried (Dames & Moore, 1977). The impacts associated with offshore disposal were also identified, and it was recommended that offshore disposal should be used as a "last resort" (Dames & Moore, 1977). The ADFG position on the matter at that time was that if offshore disposal was required, the disposal site should be moved from the present site off the tip of the Spit to a location southwest of the Spit on Archimandritof Shoals and dredging/disposal should occur during the winter (Figure 33, see insert). ADFG's position on choosing an offshore disposal site prevented adverse impacts (increased turbidity, burying organisms and associated habitat, etc.) on documented crab habitat (Dames & Moore, 1977).

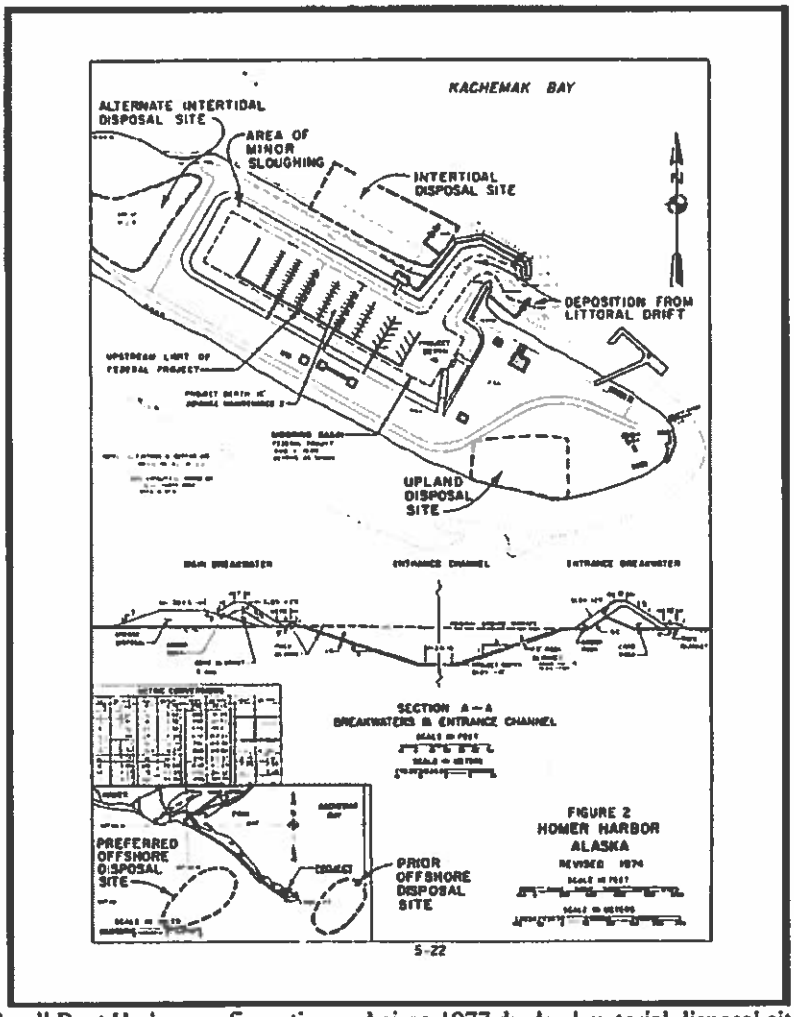

Figure 33. Homer Small Boat Harbor configuration and circa 1977 dredged material disposal sites (Dames & Moore, 1977).

Dredged material use was considered and discussed in the Corps' Homer SBH expansion Detailed Project Report and Final Homer SBH EIS (USACE, 1981). Approximately 1.6 million cy of dredged material was used as core material for breakwater construction and as fill for constructing a staging area adjacent to the expanded harbor. This resulted in the permanent loss of approximately 48 acres of intertidal habitat and 5.8 acres of subtidal habitat. Approximately 71,000 cy of dredged material remained after breakwater construction and dredging. Because the City of Homer owned the dredged material, they were responsible for identifying potential disposal sites. At that time, the City of Homer had an ordinance prohibiting the export of material from the Spit. Therefore, the city identified the following locations on the Spit for disposing the excess dredged material (Figure 34): (1) existing campground near the tip of the Spit; (2) alongside the outside (Cook Inlet side) of the Homer Spit Road; (3) commercial property inside of the Spit; (4) city-owned property; and (5) proposed campground at Mariner Park.

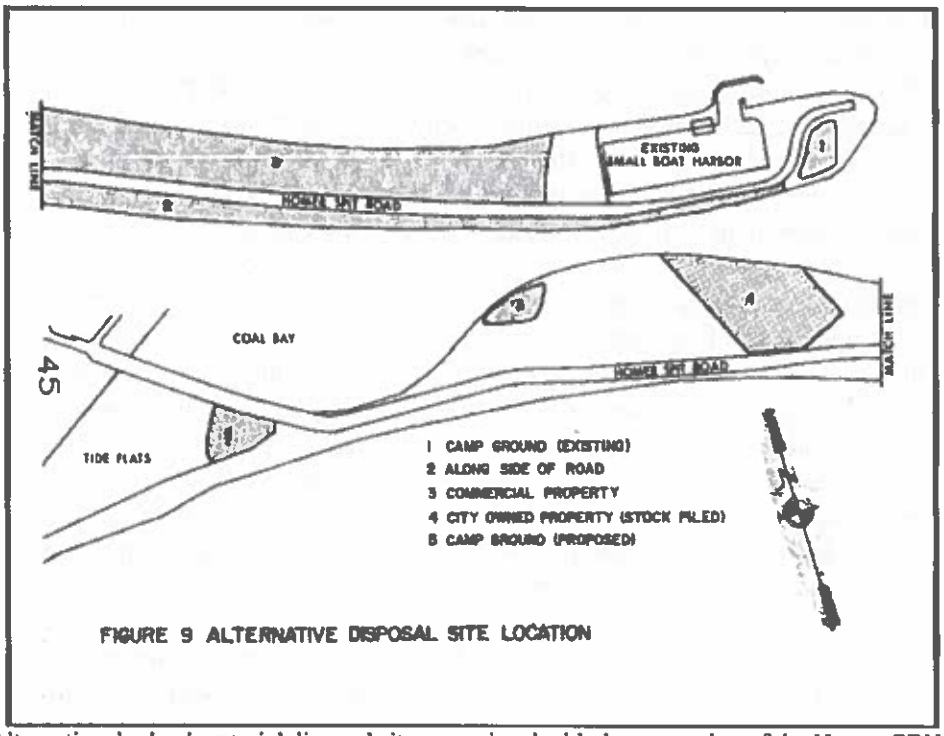

Figure 34. Alternative dredged material disposal sites associated with the expansion of the Homer SBH (USACE, 1981).

The Corps concluded in the Final Homer SBH EIS that:

(1) no significant environmental impacts would occur from disposing dredged material at the existing campground (Figure 34, Site 1) at the end of the Homer Spit;
(2) the area alongside the Outer Kachemak Bay side of the Homer Spit Road (Figure 34, Site 2) is a high energy coastline and relatively unproductive biologically and therefore no significant adverse environmental impacts would be expected to occur with placing dredged material in the area;
(3) several Corps Section 404 permits have been issued for fill activities in commercial use areas (Figure 34, Site 3);
(4) Site 4 has high bird usage and environmental impacts would vary with the methods used for containing the dredged material; and,
(5) Development of this area (Figure 34, Site 5) would require the placement of fill material into upper intertidal wetlands of low to moderate productivity (USACE, 1981).

Ultimately, the excess dredged material went to an existing stockpile area (Figure 34, Site 4) and on Clean Water Act, Section 404-permited commercial and city-owned property (Figure 34, Site 3).

Probably the most thorough environmental evaluation of the potential impacts associated with dredging and managing dredged material from the Homer SBH and USCG berth occurred in 2007, under authority of Section 101 of the WRDA of 1986, when the Corps prepared a DMMP (USACE, 2007). The DMMP's base plan included 2 weeks for dredging the boat harbor's entrance channel and USCG berth in mid-September using a hydraulic cutterhead and pipeline suction dredge; sometimes the USCG berth would require dredging a second time in April. The

environmental assessment (EA) prepared for the DMMP identified potential impacts associated with near-shore, offshore (i.e. open water), and upland disposal sites. Both the near-shore and offshore alternatives were eliminated from consideration early in the DMMP planning process because of the added transportation costs, potential environmental impacts, and conflicts with local ordinances prohibiting (at that time) the removal of dredged material off the Spit. Therefore, the upland sites were the only remaining alternatives considered, thus eliminating the need for a thorough assessment of impacts on the marine environment.

A complex array of factors is used to determine whether what is to be maintenance dredged out of the Homer SBH and USCG berth contains contaminants harmful to the receiving marine environment, such as the period between maintenance dredging, substrate characteristics (e.g. sand, gravel, or mud), water quality, and surrounding land use practices. A complex array of factors also is used to determine the possible uptake and toxicity of contaminants in dredged materials, such as the affected marine species, contaminant type(s), salinity, sediment type, and bioaccumulation (Hirsch, DiSalvo and Peddicord, 1978). The potential contaminant pathways for open-water disposal are water column (from the standpoint of chemical water quality and biological toxicity) and benthic (from the standpoint of toxicity and bioaccumulation).

The Corps sampled and analyzed Homer SBH and USCG berthing area sediments for contamination numerous times. The chemical analyses of Homer SBH sediment samples in 2002 were intended to support either upland or open-water disposal of dredged material. Arsenic and chromium levels were found to exceed State of Alaska soil cleanup standards for upland disposal; however, the concentrations of these metals were similar to the concentrations detected in the surface soils of the then-proposed upland disposal area (USACE, 2002). When the sediment chemical data were compared to open-water disposal standards (Washington State Department of Ecology and Puget Sound Dredged Disposal Analysis Program), no metal concentrations were exceeded and only one detected organic compound, butyl benzyl phthalate, exceeded any standard in two samples (USACE, 2002). Butyl benzyl phthalate is used in manufacturing plastics, particularly vinyl products, and is known to leach from these products. There are no known sources of butyl benzyl phthalate in the Homer area so its detection may be due to laboratory contamination.

Corps dredged material sampling in 2011 reported that most of the sediment did not contain compounds at concentrations above the most stringent Alaska Department of Environmental Conservation (ADEC) 18 AAC 75.341 Table B1/B2 cleanup levels for the under 40-inch zone, with the exception of arsenic and chromium. One particular area of the harbor had less than 100 cy of diesel range organic (DRO) contamination (USACE, 2012). In 2013, sediment sampling associated with the Corps' project to realign the Homer SBH entrance and maneuvering channels reported 2011-similar analytical results for arsenic and chromium (USACE, 2013).

The collective results of Corps sampling and scientific findings (USGS, 2001 and Franzel, 2002) indicate that arsenic and chromium concentrations and their distribution in Cook Inlet are naturally occurring and pose no threat to the marine environment. According to Hartwell *et al.*, (2009) the likely source of metals in Kachemak Bay are natural bedrock weathering and material transported from mountains by rivers and streams of glacial melt water. The Homer SBH is a source of petroleum-related contamination, but no large-scale industrial activities on the Spit

discharge effluent into Kachemak Bay. However, AMAP (2005) reports that long-range atmospheric transport of air-born contaminants (e.g. heavy metals, persistent pesticides such as DDT and its derivatives, PCBs and petroleum hydrocarbons) is a nonpoint contaminant source in the arctic environment.

4.3 Potential Impacts Associated with Terrestrial Dredged Material Management Sites

4.3.1 Existing Dewatering and Stockpile Area

The existing temporary dredged material dewatering site and dredged material stockpile areas are continuously disturbed upland habitat areas that have sporadic small patches of beach rye growing within their boundaries. These small vegetative patches are destroyed each year when dredged material is stockpiled there, and afterwards, the revegetation becomes reestablished. The lack of suitable habitat in and abundant human activities around the existing dewatering site and stockpile area precludes the establishment of a diverse wildlife community and therefore prevents maintenance dredging activities from adversely affecting Kachemak Bay wildlife. Even with the project area's high level of human use, gulls, shorebirds and passerine birds continue to use the dredged material stockpiles and dewatering area berms for resting. To date, no significant adverse environmental impacts have been associated with using the existing dredged material dewatering and stockpiling sites.

Future land use planning for the Spit identifies the continued use of the existing dredged material dewatering site but not so for the existing dredged material stockpile area (City of Homer, 2011; Map 5). Future plans for that area appear to indicate that the area would be used as parking lots for a new park associated with a kayak launch, festival grounds, and an area for social gatherings (City of Homer, 2011; Maps 4 and 6). The City of Homer's plans for the existing dredged material stockpile area accentuate the need to identify proactively other locations capable of being dredged material management sites in the future.

4.3.2 Parking Pad 1

The 5,000 cy of dredged material and 2,500 cy of riprap and gravel cap needed to construct the pad would permanently bury all shoreline vegetation, including patches of beach rye grass, within a 21,000 square foot area (Table 4). This action would preclude the vegetation's transient use by migratory shorebirds and other foraging birds.

Constructing the parking pad would not adversely affect intertidal organisms or other marine fish and wildlife resources (e.g. marine mammals and essential fish habitat) because no dredged material and riprap is expected to be placed below +23.4 feet MLLW, which is the high tide line (HTL). The project would also not directly or indirectly affect any threatened and endangered species (e.g. Steller's eider) inhabiting Kachemak Bay.

Table 4. Projected volumes of dredged material potentially placed in dredged material management sites, Homer Spit, Alaska

Dredged Material Management Sites		Storage capacity (cubic yards)	Notes
	Existing dredged material storage area	40,000	Material periodically sold to make room for more material.
1	Mariner Park	17,000	Parking pad improvements
2	Beach Nourishment Site 1	unlimited	Beach nourishment (1)
3	Beach Nourishment Site 2	unlimited	Beach nourishment (1)
4	Beach Nourishment Site 3	unlimited	Beach nourishment (1)
5	Parking Pad Development 1	5,000	Riprap – 1,000 cy; Gravel cap – 1,500 cy (2)
6	Parking Pad Development 2	20,000	Riprap – 3,000 cy; Gravel cap – 4,650 cy (2)
7	Outer Kachemak Bay	unlimited	60 to 139 feet deep(3)
8	Inner Kachemak Bay	unlimited	60 to 180 feet deep(3)
9	New Harbor Staging Area	190,500	Inside Homer Spit development next to existing 30-acre staging area to include removing/reusing existing "B" slope protection rock, armor rock and adding more "B" and gravel filter rock. (4)
(1) Cook Inlet side - beach replenishment sites used when the existing dredged material storage area reaches capacity.			
(2) Riprap gradation for parking pad development site has yet to be determined.			
(3) Offshore disposal sites bottom topography is dynamic and the sites would be used periodically.			
(4) New harbor is a conceptual design and not in any active planning stage by the Corps or City of Homer.			

Future land use planning for the Spit indicates a conflicting land use for the subject area. Currently, the area is zoned "Open Space Recreation." The Homer Spit Comprehensive Plan (Map 5) identifies the area as "conservation and beach access" while Map 6 identifies the area as "future parking" (City of Homer, 2011). Ultimately, this contradictory land use classification will need resolution by the City of Homer before using dredged material to construct a parking pad at this location.

4.3.3 Parking Pad 2

Approximately 20,000 cy of dredged material and 7,650 cy of riprap and gravel cap would permanently bury all shoreline vegetation, including patches of beach rye grass, within a 5.5-acre area (Table 4). This action would preclude the vegetation's transient use by migratory shorebirds and other foraging birds. Cumulatively, constructing Parking Pad 1 and Parking Pad 2 would remove approximately 6.0 acres of shoreline vegetation from permanent production, use by avian species, and open space recreation/conservation and beach access.

Constructing the parking pad would not adversely affect intertidal organisms or other marine fish and wildlife resources (e.g. marine mammals and essential fish habitat) because no dredged material and riprap is expected to be placed below +23.4 feet MLLW. The project would also not

directly or indirectly affect any threatened and endangered species (e.g. Steller's eider) inhabiting Kachemak Bay.

Identical to Parking Pad 1, future land use planning for the Spit indicates a conflicting land use for the subject area. Currently the area is zoned "Open Space Recreation." The Homer Spit Comprehensive Plan (Map 5) identifies the area as "conservation and beach access" while Map 6 identifies the area as "future parking" (City of Homer, 2011). Ultimately, this contradictory land use classification will need resolution by the City of Homer before using dredged material to construct a parking pad at this location.

4.3.4 Mariner Park Improvements

Approximately 17,000 cy of dredged material would be used to raise the surface elevation of the existing parking lot and campground area to approach the existing grade of the Homer Spit Road (Table 4). The City of Homer, however, estimated 60,000 cy of material would be incrementally used over several years to raise the parking lot and campground area elevation 2 feet and provide better drainage (November 15, 2002, letter to USACE from City of Homer, City Manager). Anticipated user-group improvements (e.g. rest rooms and interpretative/education signage) have use for the dredged material as well.

The existing parking lot provides no habitat value for neighboring wildlife resources. Therefore, no significant adverse environmental impacts are associated with placing dredged material in Mariner Park to facilitate park improvements. It is worth noting, however, that a strong public sentiment exists against any further expansion of Mariner Park by placing fill material in neighboring Mariner Lagoon, which provides high habitat value for Kachemak Bay's fish and wildlife resources (City of Homer, 2011; page 26).

4.4 Potential Impacts Associated with Marine Dredged Material Management Sites

4.4.1 Homer Spit Beach Nourishment

Beach nourishment is the process of replenishing a beach naturally by accretion due to the long shore transport or artificially by the deposition of dredged materials. Artificial beach nourishment, as a "soft" means of combating shoreline erosion and providing protection, has become a preferred method in certain areas of the U.S. (Menn *et al.*, 2003; Nelson, 1993). Menn *et al.* (2003) noted that infaunal responses to some artificial beach nourishment actions were not as dramatic when compared to natural changes along the shore and between years. From an ecological perspective, artificial beach nourishment is an acceptable method for coastal protection, if intervals of at least 3 years occur between successive operations at a given time (Menn *et al.*, (2003).

Ruggiero *et al.* (2007) classified Kachemak Bay's beaches (including those on the Spit's west side) as:

> *...mixed sediment beaches morphologically distinct from and more complex than either sand or gravel only beaches. Both the sand and coarse fractions on the beaches proposed for nourishment mobilize into self-organized bed-forms that migrate as coherent packages alongshore over a dynamic cobble substrate with a seasonality reflecting the temporal pattern of the alongshore component of wave power."*

The three shoreline areas on the Spit's west side being considered for beach nourishment are associated with a documented high energy, nearshore environment that is characterized by having a seasonally migrating sandy beach that continually buries and then uncovers inherently established intertidal and subtidal marine communities. Tide pools form on the landward side of gravel berms and sand bars as the tide recedes. Adams *et al.* (2007) documented the timing and magnitude of the migration of the Spit's west-side intertidal sand beds over gravel/cobble benches during a 22-month observation period; their findings were as follows:

1. Megatidal conditions coupled with the gentle slope of the intertidal zone on the north shore of Kachemak Bay expose a nearly 500-meter-wide beach at low tide.
2. Homer Spit's sands derive from sources along the 30-kilometer stretch of coastline, between Anchor Point and Homer, either from riverine inputs or bluff failures.
3. At depths less than 20 meters, the nearshore currents are predominantly wave driven.
4. Fine sediment in the intertidal zone moves over the gravel/cobble benches as distinct, solitary sand bed forms (sand bodies).
5. The majority of sand body cover is in the mid-tidal zone (between 1.75 meters and 3.25 meters above MLLW), and sand is present in intermittent patches near the mean high water shoreline.
6. Eastward propagating wind waves drive sand body migration as opposed to net westward-directed tidal currents.
7. The seasonal period of most rapid transport occurred in the late fall and winter, when two sustained sand body migration rates averaged 1.41 meters/day and 2.15 meters/day.
8. The more-dormant period of slow transport occurred during the late spring-summer-early fall when two sustained sand body migration rates were 0.11 meter/day and 0.07 meter/day.
9. Total migration rates for the sand bodies observed, computed over the duration of the study, ranged between 250 and 278 meters per year (0.68 to 0.76 meters per day).
10. The intertidal gravel/cobble benches remain relatively constant in elevation. In contrast, sand body migration explains beach surface elevation gains and losses of up to 0.8 meter in the region where sand bodies travel.
11. Assuming an average thickness of 0.37 meter, sand body migrations translate to a littoral transport rate between 4,400 and 6,300 cubic meters per year.
12. At the end of Homer Spit, a deep submarine trough (~100 meters deep) appears to limit the growth of Homer Spit, as sediment likely cascades down into the trough, defining a local sediment sink.
13. The authors' hypothesize Homer Spit's sand bodies are responsible for dissipating wave energy ~13 percent.

While Adams' *et al.* (2007) and Ruggiero's *et al.* (2007) research provided valuable information about the oceanographic dynamics of the subject sand bodies, however, a paucity of information exists that describes the impacts of the oceanographic dynamics on the area's intertidal habitat and organisms. Despite the high-energy oceanic environment that exists on the Spit's west side and the findings of Adams *et al.* (2007), a vibrant and thriving intertidal ecosystem manages to persevere on the cobble/gravel benches, as the Corps has documented in Appendix A. Based on the Corps' 2012 field observations, the epifauna and infauna associated with the cobble/gravel benches appear resilient enough to reestablish themselves after the sand bodies have naturally migrated off them.

In the past, the Corps placed material dredged from the harbor on tideland north of the harbor, between 0 feet MLLW and +15 feet MLLW (USACE, 1974). Disposal occurred by pushing dredged material off a floating barge into the water, allowing it to settle on the beach. High tides of +10 feet MLLW or more were required to maneuver the floating barge over the designated disposal site. Any resulting build-up areas were mechanically leveled during low tides to maintain the general slope of the beach.

The Corps is expecting to use the floating barge method to perform Spit beach nourishment activities. To accomplish a more natural process, small volumes (albeit undefined) of dewatered dredged material would be mechanically spread over small areas of beach at low tide so that the flooding tide and associated wave action would disperse the material naturally, adhering to the shoreline's original morphology. No maintenance is associated with the intertidal disposal of dredged material for beach nourishment purposes, no structural construction costs, and the lifetime capacity is virtually unlimited (Table 4).

The major categories of potential impacts associated with all three beach nourishment sites are likely to be: (1) infauna and epifauna habitat loss and mortality; (2) altered sediment transport processes; (3) increased suspended sediment loads on water quality; and (4) the effects of elutriate chemicals from dredged material.

4.4.1.1 Beach Nourishment Site 1

The exposed intertidal area at this site is vast and the three intertidal transects used to characterize its marine resources reveal an area pocketed with vegetated tide pools, sand bars, and tide flats drainage channels (Figure 10 in Appendix A). Unlike the intertidal habitat associated with the area surrounding transects BN 1-1 and BN 1-2, the area surrounding transect BN 1-3 is virtually devoid of epifauna and vegetated tide pools and is composed of sand bars and gravel-lined drainage channels (Figures 18 and 19 in Appendix A).

The infauna likely impacted from being buried by dredged material includes flatworms, nemerteans, crustaceans, mollusks and polychaetes (e.g. *Paraonella platybranchia*, and *Scolelepis* sp), which comprise 81 to 98 percent of the infauna biomass, followed by gammarid amphipods (*Eohaustorius eous* and *Paraphoxus milleri*) (Lees *et al.*, 1980).

Dewatered dredged material placed in this area at low tide would, during flooding tides, disburse naturally over substrate of similar composition (Figures 4 and 18 in Appendix A). Infauna survival would depend not only on the depth of deposited sediment, but also on the length of

burial time, season, particle-size distribution, and other habitat requirements (Nelson and Pullen, 1990).

Alternatively, material placed indiscriminately at low tide in and around BN 1-1 and BN 1-2 could destroy tide pool habitat on the landward side of gravel/sand bars and its benthic community. It is unlikely that organisms within the tide pool could vertically migrate out of the deposited dredged material, as the particle size and composition of the dredged material and tide pool substrate are substantially different (Figures 4, 13 and 15 in Appendix A).

Problems related to water quality and turbidity in this high-energy, nearshore area do not appear to be a major concern, as the dredged material to be disposed has been and would likely continue not to be classified as contaminated, and fine sediments would be rapidly transported offshore during flooding tides.

Dredged material placed at low tide would not directly affect nearshore fish populations; however, suspended solids could settle offshore and affect juvenile groundfish populations, e.g. rock sole (*Lepidopsetta* spp.) and Pacific cod, (*Gadus macrocephalus*) (Abookire, Piatt and Norcross, 2001), and essential fish habitat.

Sea otters, which are commonly found in nearshore waters, would not be adversely impacted by placing material on the beach at low tide. Dredged material placed in tide pools could, however, destroy sea otter food resources (sea urchins, mussels, etc.).

Nearshore feeding shorebirds would be temporarily displaced from feeding in intertidal areas where dredged material is placed at low tide.

Steller's eider, a threatened sea duck species, would not be affected by placing dredged material on the beach at low tide as the species: (1) is not present in the Homer area between March and November, (2) normally does not inhabit marine waters within one mile of the west side of the Spit, and (3) prefers inhabiting water approximately 20 feet deep for feeding. Harlequin ducks and black scoters, however, are documented as feeding in nearshore waters, west of the Spit, possibly on the invertebrates that inhabit the at-low-tide tide pools (Figures 13 and 15 in Appendix A).

In summary, few if any significant adverse environmental impacts would occur if small volumes (albeit undefined) of uncontaminated dredged material were placed periodically (every 3 years) at low tide in the offshore areas from BN 1-1 and on the gravel/cobble substrate between tide pools and at the foot of the rock revetment. The dredged material would disperse by natural alongshore processes that transport material southeasterly along the base of the rock revetment that protects the Homer Spit Road from storm damage and erosion. Also, placing dredged material at BN 1-2 and BN 1-3 in proximity to their tide pools would cause environmental impacts similar to those generated by documented natural oceanographic processes (i.e., migrating sand bars) along the west side of the Spit.

4.4.1.2 Beach Nourishment Site 2

Approximately 70 feet offshore of and along the 1,130-foot-long rock revetment protecting the 1,040-foot-long cantilevered steel sheet pile wall, is an 80-foot-wide tide pool heavily vegetated with algae and inhabited by a wide variety of invertebrates (Figures 20, 25-27 in Appendix A). Beyond the tide pool band is a vast area composed of sandy tide flats devoid of epifauna (Figure 29 in Appendix A).

Beach nourishment activities at this site have the potential to cause significant adverse environmental impacts if not implemented carefully. Placing any volume of dredged material, at any time of the year, into the band of tide pools will immediately bury and likely destroy an infauna and epifauna community not capable of adapting to the new substrate.

Infaunal responses to beach nourishment activities seaward of the tide pools on the sandy tide flats would not be adverse when compared to the natural seasonal changes along the shore and between years, i.e., the southeasterly migration of sand bars along the Spit. Most of the infauna taxa populating the sandy tidal flats are generally well adapted to shifting sediments and hydrodynamic turbulences (Armonies and Reise, 2000). Menn *et al.*, (2003) presumes this to be the case because the most likely affected infauna (e.g. polychaetes) are fast reproducing and often are highly mobile.

Between the tide pools and foot of the rock revetment is a narrow 35-foot-wide band of gravel/cobble substrate devoid of epi- and infauna (Figure 20 in Appendix A). Placing dredged material within this area would immediately provide erosion protection without causing any significant adverse environmental impacts as the material disperses naturally by hydrodynamic processes.

Problems related to water quality and turbidity in this high-energy, nearshore area do not appear to be a major concern, as the dredged material to be disposed of has been and would likely continue not to be classified as contaminated and fine sediments would be rapidly transported offshore during flooding tides.

Dredged material placed at low tide would not directly affect nearshore fish populations; however, suspended solids could settle offshore and affect juvenile groundfish populations, e.g. rock sole (*Lepidopsetta* spp.) and Pacific cod, (*Gadus macrocephalus*) (Abookire, Piatt and Norcross, 2001), and essential fish habitat.

Sea otters, which are commonly found in nearshore waters, would not be adversely impacted by placing material on the beach at low tide. Dredged material placed in tide pools could, however, destroy sea otter food resources (sea urchins, mussels, etc.).

Shorebirds would be temporarily displaced from feeding in intertidal areas where dredged material is placed at low tide.

Steller's eider, a threatened sea duck species, would not be affected by placing dredged material on the beach at low tide, as the species: (1) is not present in the Homer area between March and November; (2) normally does not inhabit marine waters within one mile of the west side of the

Spit; and (3) prefers inhabiting water approximately 20 feet deep for feeding. Harlequin ducks and black scoters, however, are documented to feed in nearshore waters, west of the Spit, possibly on the invertebrates that inhabit the at-low-tide tide pools.

In summary, no significant adverse environmental impacts would occur if small volumes (albeit undefined) of uncontaminated dredged material were placed periodically (every 3 years) at low tide on the tide flats seaward of the band of tide pools and on the gravel/cobble substrate between the band of tide pools and the foot of the rock revetment. Such actions would cause environmental impacts similar to the impacts associated with natural oceanographic processes (i.e., migrating sand bars) along the west side of the Spit. Placing dredged material within the band of tide pools or in areas where dredged material could be swept into the tide pools would have direct and long-term adverse impacts on in- and epifauna.

4.4.1.3 Beach Nourishment Site 3

This highly erosive segment of shoreline, as evidenced by Figures 30-34 in Appendix A, is devoid of in- and epifauna within the likely footprint of the dredged material depositional zone. No significant adverse environmental impacts would occur if small volumes (albeit undefined) of uncontaminated dredged material were placed periodically (every 3 years) at low tide between the foot of the eroding rock revetment and offshore band of gravel/cobble substrate. Potentially impacted would be the offshore tide pool organisms similarly found at BN 1 and BN 2 (Figure 36 in Appendix A). Natural oceanographic processes along the west side of the Spit are expected to distribute an unknown amount of placed dredged material offshore, into the tide pools.

Problems related to water quality and turbidity in this high-energy, nearshore area do not appear to be a major concern, as the dredged material to be disposed of has been and would likely continue not to be classified as contaminated and fine sediments would be rapidly transported offshore during flooding tides.

Dredged material placed at low tide would not directly affect nearshore fish populations; however, suspended solids could settle offshore and affect juvenile groundfish populations, e.g. rock sole (*Lepidopsetta* spp.) and Pacific cod, (*Gadus macrocephalus*) (Abookire, Piatt and Norcross, 2001), and essential fish habitat.

Sea otters, which are commonly found in Kachemak Bay's nearshore waters, would not be adversely impacted by placing material on the beach at low tide. Dredged material placed in tide pools could, however, destroy sea otter food resources (sea urchins, mussels, etc.).

Shorebirds would be temporarily displaced from feeding in intertidal areas while dredged material is placed at low tide. Steller's eider, a threatened sea duck species, would not be affected by placing dredged material on the beach at low tide, as the species: (1) is not present in the Homer area between March and November, (2) normally does not inhabit marine waters within 1 mile of the west side of the Spit, and (3) prefers inhabiting water approximately 20 feet deep for feeding. Harlequin ducks and black scoters, however, are documented as feeding in nearshore waters, west of the Spit, possibly on the invertebrates that inhabit the at-low-tide tide pools.

4.4.2 Open Water Disposal

Two methods of open water disposal using a hydraulic cutter-head suction dredge could be used to manage material dredged from the Homer SBH and USCG berthing area. Dredged material could be pumped as a slurry through a pipeline and discharged directly into Kachemak Bay's nearshore waters or dredged material could be pumped as a slurry into a barge, dewatered, and transported to open water sites for disposal in Kachemak Bay. Environmental considerations associated with these methods include increased turbidity/decreased water quality, contaminated sediment, benthic organisms' mortality, fish migration and movement, marine mammal and avian harassment, and disruptions to navigation.

Discharging dredged material generated by a hydraulic cutter-head suction dredge into the marine environment would substantially increase turbidity and suspended solids. More than likely both disposal methods (direct discharge or barge dewatering and subsequent disposal) would result in levels of turbidity exceeding the State of Alaska's water quality standard (18 AAC 70) of 25 Nephelometric Turbidity Units (NTU)), as the slurry is expected to be 90 percent water and 10 percent sediment. However, turbidity levels in Kachemak Bay around the Spit vary naturally depending on weather conditions, tide level, wind and current conditions, and location (Table 5). During periods with high surf or surface runoff, for example, nearshore waters can be extremely turbid for extended periods. Inner Kachemak Bay's mud flats north of the harbor would most likely have higher turbidity readings than the Outer Kachemak Bay side of the Spit because of its shallow depth and soft substrate.

The substantial amount of turbidity generated by oceanic disposal can cause mechanical abrasion of fish gills and other delicate exposed structures of finfish and shellfish, destruction of segments in the food web and reduction in light penetration, burial of benthic organisms by the accumulation of sediments, and disruptive changes in habitat. Differences in recovery times depend on the number of successional stages required to repopulate the habitat. Hartwell *et al.* (2009) and others (Maguire Group Inc., 2005; Oliver *et al*, 1977) report that invertebrate communities inhabiting naturally highly variable and frequently disrupted physical environments

Table 5. Turbidity measurements from Kachemak Bay (USACE, 2007)

Sampling Month/year	Sampled by:	Sample Depth	Turbidity (NTU)	Sampling Location
3/2003	USACE	Surface	40	Inside Homer SBH at end of boat ramp
2/2003	ADFG	Surface	126	Bay side offshore of mudflats between harbor and fishing hole
2/2003	ADFG	Surface	5	Ocean side off existing effluent pipeline
8/01-12/02	ADFG	1m off bottom	9.65 (13 month avg.)	Off ferry dock-bay side near end of Homer Spit
?/2008	NOAA	Surface and 72.2 m	3.58 and 4.03	Off the tip of Homer Spit

USACE - U.S. Army Corps of Engineers, Alaska District; ADFG - Alaska Department of Fish and Game; NOAA – National Oceanic and Atmospheric Administration

(e.g. shallow water in offshore areas) recover more quickly than invertebrate communities inhabiting less variable and undisturbed natural areas (e.g. deeper water offshore). This is because species typical of naturally unstressed assemblages do not possess life-history traits to allow rapid recolonization of disturbances. In general, recovery within 9 months to 2 years can be achieved, although deeper habitats can take up to 4 years to recover (Maguire Group Inc., 2005; Oliver *et al*, 1977; Hartwell *et al.*, 2009).

4.4.2.1 Outer Kachemak Bay

The Outer Kachemak Bay site (Figure 29) coincides with an open water site used by the Corps, prior to 1974, for disposal of material maintenance-dredged from the Homer SBH (Figure 2). The previously used site is 10 square miles at the edge of Archimandritof Shoals, with depths ranging from 100 to 350 feet. Historically, commercial shrimp fishermen avoided the area because of rough bottom conditions and crab fishermen lost gear in the area due to seagoing vessels using the area as a turning point and anchorage during their pilotage stops.

In 1974, the Corps calculated that if the site were continually used: (1) the material barge would be towed out to the site at 5 to 7 miles per hour, (2) 2 to 3 hours would be required to dump the material from the barge, (3) the barge would carry approximately 300 cy per trip, and (4) about 7 hours would be required for each complete trip from the disposal area to the dredge and return to disposal area (USACE, 1974). Assuming the dredged material would settle over a 100-yard-wide path, the Corps calculated that the material would cover the area with a sediment layer less than 0.5 inch in depth (USACE, 1974). The Corps also assumed that there would be uniform disposal and near vertical settling of particles, which in practice, is not feasible. The Corps concluded that, "... the thickness of the material layer settling over any one area would be minute and the probability of burying or smothering any organism slight" (USACE, 1974). Ultimately, the maintenance-dredged material was placed intertidally rather than in open water because it was more economically feasible to dispose of the material on uplands and in nearby intertidal areas.

The Corps' 2012 field investigation mirrored those findings of Hartwell *et al.* (2009), that is, the bottom sediment is composed of mud, clay, silt, and coal fragments (Figure 54 in Appendix A). However, the dredged material placed at this site would consist of sediments with grain size distributions that differ to varying degrees from those of the existing substrate. Material dredged from the Homer SBH is 62 percent gravel, 36 percent sand, and 2 percent fines (Figure 9). This disparity of sediment type would alter the bottom substrate and affect those organisms living upon and within it, which according to Hartwell *et al.* (2009), consists of polychaetes, bivalves, malacostraca, and gastropods. The resultant habitat would be less suitable for deposit feeders but would be suitable for macro-epifauna; therefore, a shift is likely to occur but not appreciably alter the overall benthic composition at the disposal site.

Historically, the dredged material from the Homer SBH and USCG berth has never been classified as contaminated, as the sediment-chemistry is comparable to ambient sediments and did not exceed USACE/EPA minimum sediment guidelines or conservative ecological benchmarks. Therefore, the Corps believes that periodic open water disposal at this site will not cause any long-term or adverse sediment quality impacts.

Because of Kachemak Bay's status as a research reserve, two permanent stations monitor the bay's water quality (e.g. turbidity, dissolved oxygen, and pH): one at the tip of the Spit and one in Seldovia Bay (http://www.ndbc.noaa.gov/station_page.php?station=kcha2). At each water quality station, one data logger is 1 meter below the surface and another data logger is 1 meter above the bottom. The primary concern with respect to water quality, however, is increased turbidity during disposal activities. Dredged material that does not fall to the seafloor immediately (e.g. fine-grained components) will entrain in the water column, travel away from the site as a plume, and eventually dilute to mirror background turbidity levels. The ultimate fate of the plume at the candidate site, however, would need to be simulated using data from the Kachemak Bay water quality monitoring station in short-term and long-term fate models (USEPA/USACE, 1991).

Demersal finfish feeding on the bottom that do not avoid sinking dredged material would be covered by a thin layer of sediment, but most juvenile and adult finfish would avoid the descending dredged material and the temporary zone of increased turbidity. Boehlert and Morgan (1985), however, observed that turbid conditions enhanced the visual contrast of prey items thus increasing the overall feeding rates of larval Pacific herring. Increased turbidity and associated enhanced cover was also associated with increased foraging rates in Chinook salmon, (Gregory and Northcote, 1993). On the other hand, increased turbidity can induce a surfacing response, which would increase finfish vulnerability to predation. Long-term changes in the character of the habitat for finfish, however, are not anticipated because the benthic community important in the local ecological food chain would re-colonize to ambient status. As has been the case to date, the Corps does not perform Homer SBH and USCG berth dredging or disposal activities between May 1 and July 15 to prevent adverse impacts to out-migrating juvenile salmon.

While filter or suspension feeders may experience decreased efficiencies during intense episodes of high turbidity, there are no data to indicate that this causes a long-term problem. Based on NMFS research trawls, pandalid shrimp use the area (Galler, 1973); however, most shellfish are unlikely to be impacted by turbidity changes because the burial by deposition of suspended solids is expected to be gradual. Suspended sediments/turbidity may have either positive or negative effects on growth in bivalves, depending on the type and concentration of the particulates and bivalve species. Although adult bivalves are relatively immune, some studies indicate a higher level of sensitivity to temporary increases in suspended sediment/turbidity in bivalve eggs and larvae, as reflected in their growth and development. (Bricelj et al., 1984).

Approximately 300 Steller's eider (a USFWS threatened species) overwinter and molt during the winter in shallow waters up to a mile or more offshore on the Cook Inlet side of the Spit. Individuals arrive in November and depart during March or early April. No Steller's eider critical habitat exists in Kachemak Bay or anywhere within Cook Inlet. In addition to the fisheries-related dredging prohibition, the Corps does not dredge between November 15 and March 30 to prevent adversely affecting overwintering Steller's eider.

In response to the significant population decline, the NMFS designated the Cook Inlet stock of beluga whales as "depleted" under the Marine Mammal Protection Act (MMPA) and Kachemak Bay's entire area is within the species' Cook Inlet Critical Habitat Area 2. The NMFS-

endangered Steller sea lion - western stock, is a frequent visitor to the Homer SBH and Spit offshore areas, as well as the endangered humpback whale. Northern sea otter (Southcentral Distinct Population Segment), harbor seal, orca whale, and Dall porpoise occasionally enter Kachemak Bay. Dredging operations within the boat harbor and at the USCG berth will not affect the aforementioned marine mammal species; however, pipeline or barging open water disposal activities would likely displace marine mammals temporarily from using the area.

Local commercial and recreational fishing activities will be minimally impacted by pipeline or barging open water disposal activities at this site, based on the relatively small size of the disposal site, the limited time of the year when disposal would occur, and because the impacts would remain localized (i.e., not extend into known commercial and recreational fishing areas). Specifically, use of the designated site may necessitate commercial and recreational fishing boats to avoid the disposal site during the disposal operations.

In summary, placement of dredged material within this site would cause a temporary decrease in water quality (i.e., in terms of total suspended solids and turbidity). No long-term adverse impacts would occur to the area's bathymetry or benthic communities; however, such a determination would have to be validated using a series of sediment transport and fate simulations (using the MDFATE model developed by the USACE Engineer Research and Development Center) to estimate effects in the water column and on the substrate. If used, the disposal site requires periodic monitoring to verify that benthic community recovery occurs as predicted and to allow early detection and mitigation of any longer-term adverse impacts. No marine mammals or endangered/threatened species would be adversely impacted if this site were used for open water disposal. Finally, disposal activities would minimally impact local commercial and recreational fishing activities.

4.4.2.2 Inner Kachemak Bay

With few exceptions, the environmental impacts associated with using the Inner Kachemak Bay open water site for the disposal of dredged material from the Homer SBH and USCG berth are identical to those associated with using the Outer Kachemak Bay site for the same aforementioned reasons. Some exceptions include:

- Fewer marine mammal species and overwintering Steller's eider would potentially be impacted because this site's proximity to the daily activities associated with the Homer SBH entrance channel, commercial docks, and piers deter wildlife from using the area (Figure 29).
- Using this site would have a significant effect on vessel traffic because boats exiting and entering the harbor and using the docks would have to avoid the nearby disposal site during the dredging/disposal operations.
- Because of the disposal site's proximity to the harbor and USCG berth, dredged sediment would likely be pumped directly to the disposal site via a submerged pipeline and discharged at depth.
- Information must be obtained to confirm that high-value habitat for shellfish does not exist at the disposal site.

Unlike the Outer Kachemak Bay open water disposal site, this site is not within the Kachemak Bay CHA (Figure 32), and therefore, is not directly subjected to ADFG "special area permit (SAP)" jurisdiction. However, because disposing of dredged material at this site could generate impacts extending beyond the zone of deposition (e.g. a migrating turbidity plume) into the Kachemak Bay CHA, a SAP is likely required.

Overall, depositing dredged material at this site would not cause adverse impacts to marine mammals, endangered species, and finfish. Short-term adverse impacts to benthic communities and water quality, however, are expected. These impacts would have to be validated using a series of sediment transport and fate simulations (using the MDFATE model developed by the USACE Engineer Research and Development Center) to estimate effects in the water column and on the substrate. If used, the disposal site requires periodic monitoring to verify that benthic community recovery occurs as predicted and to allow early detection and mitigation of any longer-term adverse impacts.

4.4.2.3 Lower Cook Inlet

Currently, no permitted or EPA-approved dredged material disposal sites exist in Lower Cook Inlet. The Corps considered establishing such a site when preparing the Homer SBH Final O&M EIS (USACE, 1974) and Homer SBH and USCG dock DMMP (USACE, 2007) (Figure 3). This report considers establishing an open water disposal site in Lower Cook Inlet approximately 20 miles from the Spit, outside the Kachemak Bay CHA, within the territorial sea (Figure 35). NOAA marine chart number 16640 describes the area's bottom type as mostly sand with shell debris, but some hard and rocky substrate exists as well.

There is a paucity of biological information about the proposed disposal area, but it is known that the area coincides with a region heavily utilized by both larvae king crab and pandalid shrimp during the late spring and early summer months, especially nearshore from Anchor Point to the Spit (Galler, 1973). The area also supports a large invertebrate biomass, most of which are important as forage for large populations of predatory fish. Bivalve mollusks are especially abundant in some areas, including razor clams, snails, and mussels. Lower Cook Inlet is famous for its Pacific halibut fishery and many charter sports fishing vessels that fish in Lower Cook Inlet moor in the Homer SBH.

The Corps expects the type of impacts generated at this site to be similar to those impacts generated at the Inner and Outer Kachemak Bay disposal sites: (1) temporary water quality degradation related to increased turbidity and suspended sediments, (2) the burial of shellfish and benthic communities, (3) temporarily displacing marine mammals and finfish, and (4) temporarily excluding commercial and recreational activities from using the disposal area. Until more site-specific biological information is available, the Corps cannot conclusively determine the site's environmental feasibility. Furthermore, the cost and time required for environmental data collection, in conjunction with the added cost of transporting dredged material to the site, may make selecting this alternative impracticable, as was determined to be the case in past evaluations.

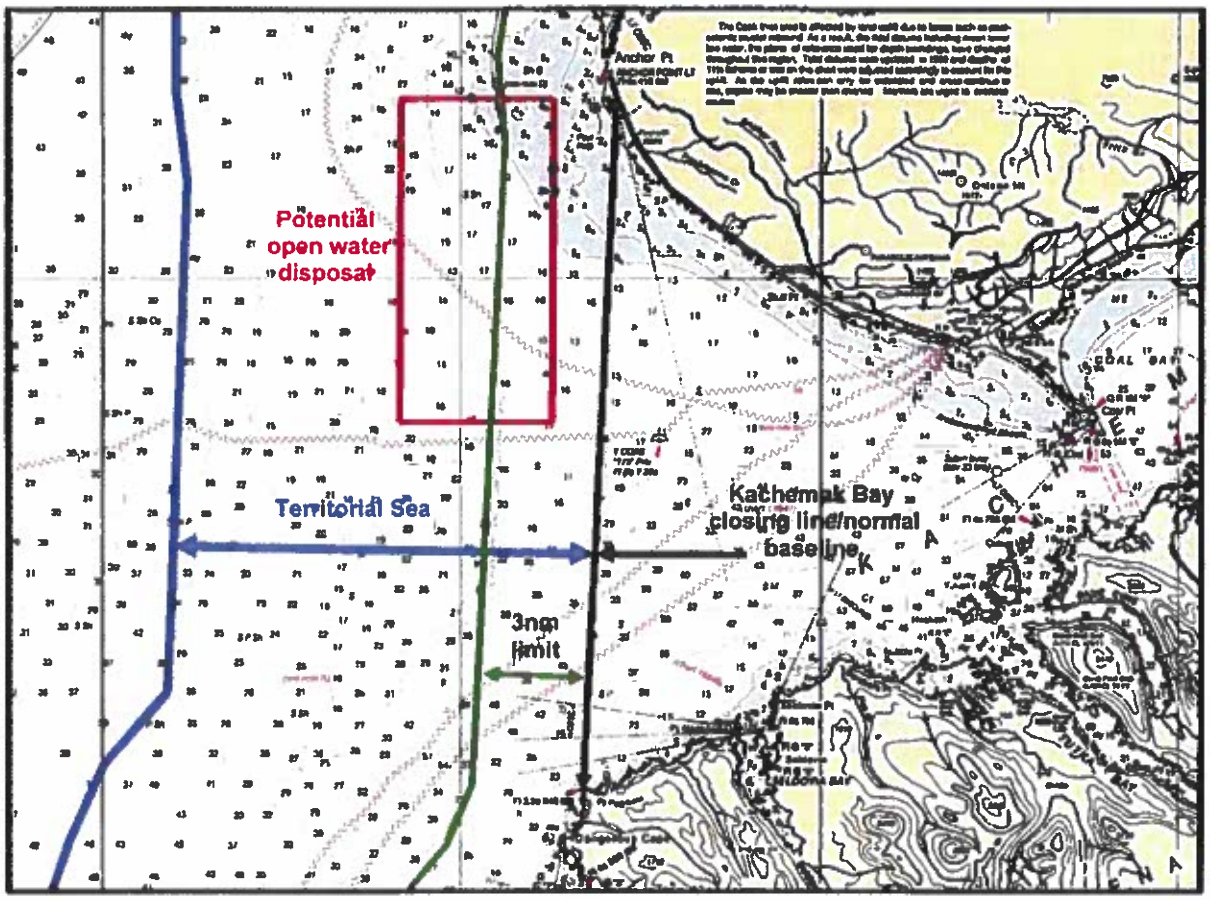

Figure 35. Potential open water dredged material disposal site in Lower Cook Inlet, outside of Kachemak Bay, Alaska

4.4.3 New Harbor Staging Area

Dredged material used as fill in the subject 9-acre area would be used for constructing additional upland areas to support existing and anticipated new harbor facilities (Figures 23 and 32), which the Corps and City of Homer proposed in 2008. Even though the new harbor staging area is not located in the Kachemak Bay CHA, using the site would generate impacts extending beyond the zone of deposition (e.g. a migrating turbidity plume) into the Kachemak Bay CHA, and therefore, a SAP would likely be required.

Related to the possible construction of a new harbor, the Corps funded the ADFG/KBRR to conduct a comprehensive marine habitat inventory in the project area and surrounding habitats so that potential biological impacts could be identified. Data was collected using beach seines, crab traps, and at least one SCUBA dive survey. The marine habitat inventory characterized the fish, invertebrate, and submerged aquatic vegetative communities in the projected impact area throughout a calendar year.

The Corps' 2012 field investigation confirmed what ADFG and other investigators found at the project area. A mixed-substrate assemblage is in both the intertidal and subtidal zones on the protected Kachemak Bay side of the Spit. Mussel beds exist that are associated with kelps

(*Laminaria saccharina* and *Alaria taeniatra*), sea lettuce (*Monostroma* sp. and *Ulva* sp.), sea stars (*Evasterias troschelii* and *Leptasterias ploaris acervata*), a sea anemone (*Anthopleura artemisia*), and the basket cockle (*Clinocardium nuttallii*). Mussel beds are an important year-round feeding area for Kachemak Bay's waterfowl. Macro assemblages of green sea urchin (*Strongylocentrotus drobachiensis*), stalked anemone, Dungeness crab (*Cancer magister*), small prickleback, sea stars, and sculpin (*Myoxocephalus polyacanthocephalus*) also exist (Dames and Moore, 1981). Although not abundant, patches of eelgrass were found throughout the mid-intertidal zones.

The proposed area would require constructing an offshore berm or wall to contain the dredged materials. The impacts foreseen by the subject construction and fill activities would be: (1) the permanent loss of intertidal and subtidal benthic habitat, (2) changes in circulation patterns due to a modified shoreline and substrate topography, (3) increased turbidity and sedimentation from dredged material disposal and shoreline construction activities, and (4) disturbing important habitat for juvenile coho salmon (Sarzi personal communication).

Intertidal and subtidal habitat loss would have a direct effect on sessile organisms, particularly clams, sea pens, anemones, and slow-moving mobile organisms like sea stars. Permanently destroyed would be periphytic algal species, kelp, and eelgrass patches within the project footprint. While construction of the new shoreline is actively taking place, more mobile organisms (e.g. fish, crabs, shrimp, and to a lesser degree sea stars) would be expected to emigrate from the area and inhabit surrounding habitats, minimizing mortality but nonetheless resulting in habitat loss. The permanent loss of intertidal and subtidal benthic habitat would, however, be compensated with new intertidal and subtidal habitat being available on the newly constructed armor-stone-lined shoreline that would eventually be re-colonized by shallow water adapted species (i.e. mussels and barnacles).

Since any construction that occurs will likely add shoreline dimensionality to the Spit, a more complicated circulation pattern will result, thereby decreasing the nearshore currents. Increased sedimentation rates could result in further alteration of the shoreline, creating sand bars and or backfilling areas where sedimentation was historically not a problem. This would be of particular concern with regard to the adjacent Nick Dudiak Fishing Lagoon where the ADFG operates a stocking program to enhance fishing opportunities on the Homer Spit. Increased sedimentation in this area could cut off and/or fill in this lagoon making it impossible to operate an enhancement program in this area and difficult for anglers to access adult fish returning to this region. A model of circulation and sedimentation patterns with the proposed project in place would help refine the delineation of potential environmental impacts.

Short term increases in turbidity and sedimentation from constructing the new shoreline and using dredged material to construct uplands are likely to have a minimal impacts on the clams, sea pens, sea stars, kelp, anemones, and other marine species that dominate the east side of the Spit. Minimal impacts are expected because these species and community assemblages are already exposed to high levels of sedimentation and turbidity from the eroding bluffs on the north side of Kachemak Bay, the runoff from glaciers on the south side of Kachemak Bay, and from wave action during winter storms.

5.0 DREDGED MATERIAL MANAGEMENT REGULATORY STATUTES, JURISDICTIONS AND AUTHORITIES

The State of Alaska, Corps, and EPA have regulatory authority governing the management of dredged material. The Corps and EPA share responsibility for the regulation of dredged material in the waters of the U.S. under Section 404 of the Clean Water Act (CWA), and for the regulation of dredged material within ocean waters under Section 103 of the Marine Protection, Research and Sanctuaries Act (MPRSA). The ADEC, in accordance with Section 401 of the CWA, determines whether discharges into waters of the United States comply with Alaska WQS (18 AAC 70), and other applicable State laws. Section 10 of the Rivers and Harbors Act (RHA), requires the Corps to issue a permit for placing or disposing dredged material in navigable waters of the United States.

The sections that follow provide an overview of the primary regulatory statutes and jurisdictions governing the management of dredged material, as well as other pertinent and applicable laws and regulations.

5.1 Marine Protection, Research and Sanctuaries Act

The MPRSA, also known as the Ocean Dumping Act (33 U.S.C. 1401 *et seq.*), governs the transportation of dredged material **for the purpose of disposal** [emphasis added] into ocean waters, seaward of the baseline of the territorial sea (Figure 36). In accordance with Section 103 of the MPRSA, the Corps is the permitting authority for ocean disposal of dredged material, subject to EPA review and concurrence. Proposed ocean disposal of dredged material must comply with the permitting and dredging criteria in the regulations in 33 CFR Parts 321-330 and 335-338. If EPA determines the criteria are not met, disposal may not occur without a waiver of the criteria by EPA.

Section 103(b) of the MPRSA requires that the Corps utilize dredged material disposal sites designated, per Section 102 of the MPRSA, by the EPA to the maximum extent feasible. Where use of a site designated by EPA is not feasible, the Corps may, with the concurrence of EPA, select an alternative ocean disposal site using the EPA site selection criteria. Disposal at or in the vicinity of an alternative site shall be limited to a period of not greater than 5 years unless the site is subsequently designated pursuant to Section 102(c). An alternative site may continue to be used that does not exceed 5 years if: (1) no feasible disposal site has been designated by EPA, (2) the continued use of the alternative site is necessary to maintain navigation and facilitate interstate or international commerce, and (3) the EPA determines that the continued use of the site does not pose an unacceptable risk to the human health, aquatic resources, or the environment.

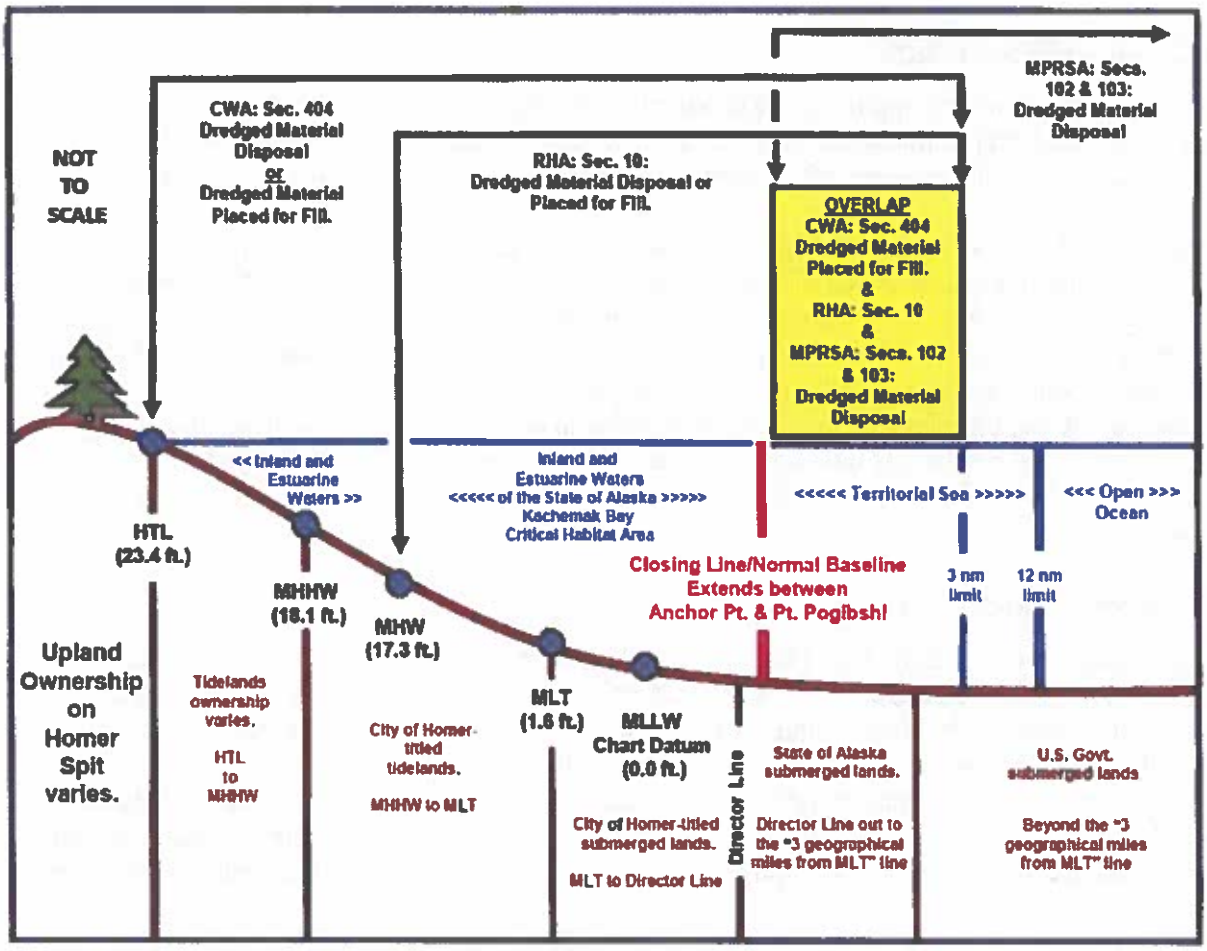

Figure 36. Submerged lands ownership and Federal regulatory authorities pertaining to dredged material disposal, or dredged material placed for fill in U.S. waters (Katchemak Bay and Lower Cook Inlet) surrounding Homer Spit, Homer, AK. NOTE: CWA – Clean Water Act; MPRSA – Marine Protection, Research and Sanctuaries Act; RHA – Rivers and Harbors Act; HTL– high tide line; MHHW - mean higher high water; MHW - mean high water; MLT – mean low tide; MLLW - mean lower low water; nm – nautical mile.

Permits issued under the MPRSA specify the type of material to be disposed of, the amount transported for disposal, the location of the disposal site; the length of time the permit is valid, and special provisions for surveillance. The EPA can require a permit application to provide information necessary for the review and evaluation of the application.

An ocean dredged material disposal site is required to have a site management and monitoring plan. Management of the site involves regulating the times, quantity, and characteristics of material disposed of at the site, and establishes disposal controls, conditions, and requirements to avoid or minimize potential impacts to the marine environment. Monitoring the site ensures that disposal will not unreasonably degrade or endanger human health or the environment, to verify that unanticipated adverse effects are not occurring from past or continued use of the site, and to ensure that permit terms are met.

5.2 Clean Water Act

The CWA, Section 404, applies to the discharge of dredged material into waters of the U.S. **for the purpose as fill** [emphasis added], inside the baseline of the territorial sea to the high tide line, as well as waters seaward of the baseline a distance of 3 nautical miles (Figure 36).

Section 404(b)(1) assigns to the Corps the responsibility for authorizing and permitting (*aka* Corps Permit) all such proposed discharges and requires application of the Section 404(b)(1) guidelines in assessing the environmental acceptability of the proposed action. The Corps is also required to examine the least environmentally damaging practicable alternative (LEDPA) to the proposed discharge, including alternatives to disposal into waters of the United States. A Corps Permit is also required for placing dredged material in an upland environment when effluent from the disposal discharges into waters of the United States. The EPA is responsible for environmental oversight under Section 404 and retains permit veto authority pursuant to Section 404(c).

5.3 Rivers and Harbors Act

Under Section 10 of the RHA of 1899 (33 U.S.C. 403; see 33 CFR part 322), a Corps permit is required for certain structures or work in or affecting navigable waters of the United States. Navigable waters of the United States, over which the Corps' Section 10 regulatory jurisdiction extends for the management of dredged material, includes all coastal waters within a zone that extends from MHW seaward of the baseline 3 nautical miles within the territorial sea (Figure 36). A dredging project in navigable waters, with no discharge of fill material or return flow back into the navigable waters, would require a Section 10 Corps permit but not a Section 404 Corps permit.

5.4 Overlapping Federal Statues and Jurisdictions

It is necessary to define the baseline of the territorial sea in order to understand the geographic jurisdiction of the CWA, MPRSA and RHA. International and domestic law both define the baseline as the boundary line dividing the land from the ocean. In the United States, the baseline is the MLLW line along the coast as shown on official nautical charts; however, there are exceptions (e.g. baselines across river mouths, the opening of bays, and along the outer points of complex coastlines), which is the case regarding Homer. Homer Spit lies within Kachemak Bay's inland and estuarine waters, as defined by the normal baseline/closing line extending across the mouth of Kachemak Bay from Anchor Point to Point Pogibshi (Figures and 35 and 36).

Because of overlapping CWA and MPRSA statutes in the first 3 nautical miles seaward of the baseline, EPA and Corps regulations [respectively 40 CFR 230.2(b) and 33 CFR 336.0(b)] define which law applies in this 3-nautical-mile-wide belt. If dredged material is discharged in the 3-nautical-mile-wide belt **for the purpose of disposal** [emphasis added], it is evaluated under the MPRSA. If dredged material is placed in the 3-nautical-mile-wide belt **for the purpose as fill** [emphasis added] (e.g. beach nourishment or island creation), it is evaluated under Section 404 of the CWA. Figure 36 illustrates the relationship of the CWA, MPRSA, and RHA as they apply

to the disposal of dredged material and/or the placement of dredged material as fill in the waters surrounding Homer Spit, i.e. Kachemak Bay and Lower Cook Inlet.

As a matter of policy the Corps does not issue itself permits under any of the regulatory authorities it administers (Section 10 of the RHA, Section 404 of the CWA and Section 103 of the MPRSA). Unless otherwise exempt, the Corps complies with the same laws and regulations that apply to applications for Corps permits.

5.5 Other Applicable Laws, Regulations and Authorities

This section provides an overview of the more applicable and commonly used Federal and state laws, regulations, and authorities related to managing dredged material from the Homer SBH and USCG dock.

5.5.1 State of Alaska

5.5.1.1 Alaska Department of Fish and Game: Kachemak Bay Critical Habitat Area

The Alaska Legislature in 1974 established the tide and submerged lands of Kachemak Bay as a CHA to protect and preserve habitat areas especially crucial to the perpetuation of fish and wildlife, and to restrict all other uses not compatible with that primary purpose (Figure 31). The ADFG manages the area and an SAP is required from them for any habitat altering activity in the critical habitat area, minus the area surrounding the Port of Homer, which is excluded from the CHA (Figure 32).

The CHA is open to most public uses provided the activity does not damage refuge resources, disturb wildlife or disrupt existing public uses. Land and water use activities requiring a SAP include (as described in 5AAC 95.420), but are not limited to:

- construction or placement of structures;
- damaging or clearing vegetation;
- surface or shoreline altering activities;
- natural resource development or energy exploration;
- waste disposal; and
- any other activity that is likely to have a significant effect on vegetation, drainage, water quality, soil stability, fish, wildlife, or their habitat, or which disturbs fish or wildlife.

The ADFG Habitat and Restoration Division reviews all proposed activities within the critical habitat area for consistency with the goals and policies outlined in the area's management plan. Activities are either approved, conditioned, or denied based on the direction provided in the management plan as well as state laws and regulations.

5.5.1.2 Alaska Department of Environmental Conservation: Clean Water Act, Section 401

In accordance with Section 401 of the CWA, any applicant for a Federal permit to conduct an activity that might result in a discharge into waters of the U.S. must also apply for and obtain certification from the ADEC that the discharge will comply with the CWA, the Alaska WQS (18 AAC 70), and other applicable State laws. By agreement between the Corps and ADEC, an application for a Corps permit to discharge dredged and/or fill material into waters of the United States under Section 404 of the CWA may also serve as an application for ADEC 401 water quality certification.

After reviewing the Corps' public notice for a permit-applied discharge, ADEC may certify there is a reasonable assurance that any discharge that might result will comply with the CWA, the Alaska WQS (which are based on Federal water quality criteria), and other applicable State laws. ADEC may also decide to deny or waive certification of any activity.

5.5.1.3 Alaska Department of Environmental Conservation: Solid Waste Program

This program issues permits for the disposal of solid waste, contaminated soil, and the terrestrial placement of (contaminated and uncontaminated) dredged material. The ADEC Solid Waste Program regulates health and environmental compliance at solid waste facilities through a combination of design review, permits and authorizations, inspections, monitoring, and compliance assistance.

5.5.2 Federal

5.5.2.1 National Environmental Policy Act

For Corps dredging projects (either for new construction or maintenance dredging), the Corps is responsible under NEPA for developing alternatives for all facets of the dredging and discharge operation, including cost, technical feasibility, and overall environmental protection. Corps regulations state that the preferred alternative must be the least costly plan that is consistent with environmental statutes, as set forth in the National Economic Development Plan for new work projects (ER 1105-2-100) or as the Federal Standard for required maintenance dredging of existing projects (like those at the Homer SBH and USCG dock) (33 CFR 335-338). Compliance with the environmental criteria of the MPRSA and/or with the CWA 404(b)(1) Guidelines is a controlling factor used by the Corps in determining the environmental acceptability of dredged material management alternatives.

5.5.2.2 Coastal Zone Management Act

Corps activities that affect the coastal zone are to be carried out in a manner consistent, to the maximum extent practicable, with the enforceable policies of the approved state management program. However, the State of Alaska withdrew from the voluntary National Coastal Zone Management Program on July 1, 2011. Therefore, within the State of Alaska, the Federal consistency requirements under the Coastal Zone Management Act do not apply to the Corps, those seeking any form of Federal authorization or permit, and state and local government entities applying for Federal assistance.

5.5.2.3 Endangered Species Act

The Corps is required to coordinate with both the USFWS and NMFS to identify what Endangered Species Act-listed species under those agencies respective jurisdictions may be present in the project area and to determine how the Corps' project might affect those species and their habitat. During consultation, the Corps cannot make any irreversible or irretrievable commitment of resources that would preclude the formation or implementation of any reasonable and prudent alternative measures.

5.5.2.4 Fish and Wildlife Coordination Act

The Fish and Wildlife Coordination Act (FWCA) requires the Corps to consult with the USFWS whenever the waters of any stream or other body of water are proposed to be impounded, diverted, or otherwise modified. However, unlike for the development of Corps civil works water resources projects, operation and maintenance projects (e.g. maintenance dredging and breakwater repair) do not require the submission of USFWS planning aid reports or FWCA Reports.

5.5.2.5 Marine Mammal Protection Act

The Corps is required to coordinate with the USFWS and NMFS on potential impacts to species covered by this act and address agency concerns and recommendations. The Corps must take all practicable measures to avoid "taking" of marine mammals. If the "taking" of a marine mammal is unavoidable, then the Corps must begin the process of obtaining a permit for the "take."

5.5.2.6 Migratory Bird Treaty Act

The Corps is required to avoid a "taking" under this act during construction of a project, as it is unlawful, except as permitted by regulations, "to pursue, hunt, take, capture, kill…any migratory bird, any part, nest or egg," or any product of any bird species protected by the Act.

5.5.2.7 National Historic Preservation Act of 1966, as amended

Federal agencies are required to identify cultural or historic resources that may be affected by a project and, based on their findings, consult with the State Historic Preservation Officer. The Corps must be able to document compliance with the Act by including relevant coordination or consultation correspondence, study results, agency views and comments, and, if required, mitigation plans in Corps project reports and NEPA documents.

5.5.2.8 Executive Order 11990 - Protection of Wetlands

To the extent possible, Federal agencies should avoid, for the long and short term, adverse impacts associated with the destruction or modification of wetlands and avoid direct or indirect support of new construction in wetlands wherever there is a practicable alternative.

5.5.2.9 Executive Order 13112 – Invasive Species

Each Federal agency whose actions may affect the status of invasive species shall, to the extent practicable and permitted by law, prevent the introduction of invasive species.

5.5.2.10 Executive Order 12898 – Environmental Justice in Minority Populations and Low-income populations.

Each Federal agency shall conduct its programs, policies, and activities that substantially affect human health or the environment, in a manner that ensures that such activities do not have the effect of excluding persons from participation in, denying persons the benefits of, or subjecting persons to discrimination.

5.5.2.11 U.S. Army Corps of Engineers – Civil Works Regulations, Authorities and Policies

Federal laws have established the authority of the Corps to use dredged material for beneficial purposes, and programs now exist implementing these laws (e.g. WRDA of 1986). The most commonly used authority for the beneficial use of maintenance-dredged material is Section 204 of WRDA 1992, as amended, which allows incremental costs for protecting, restoring, or creating aquatic and ecologically related habitat to be shared on a 75 percent Federal and 25 percent non-Federal basis. Section 207 of WRDA 1996 amends Section 204 of WRDA 1992 to authorize funding for beneficial use projects that achieve environmental benefits such as wetland creation. Opportunities for beneficial use projects in conjunction with maintenance dredging are routinely identified by the Corps through dredge material management planning efforts, interagency planning and management efforts (e.g. National Estuary Program and Coastal America), state or local planning efforts, and through general coordination activities with Federal and state resource agencies.

Beneficial uses of dredged material involve the placement or use of the said material for: (1) habitat development, e.g., wetland restoration/creation and fishery enhancement; (2) development of parks and recreation facilities, e.g., walking and bicycle trails and wildlife viewing areas; and (3) beach nourishment, e.g., restoration of eroding beaches and protecting eroding shorelines. The Corps estimates that nationally, 20 to 30 percent of the total volume of dredged material is currently used beneficially (USEPA, 2007).

5.5.3 Federal and State of Alaska Permits

Managing dredged material requires coordinating with many state and Federal agencies and depending on the circumstances could require obtaining a variety of permits and authorizations. Depending on circumstances, placing dredged material from the Spit into Kachemak Bay (i.e. into waters of the United States), a Corps (CWA Section 404, the RHA Section 10 or the MPRSA Section 103) Permit and ADFG SAP will be required. The City of Homer and public are required to apply for and receive a Corps permit for any proposal to place dredged material into Kachemak Bay, below the high tide line of 23.4 feet. (http://www.poa.usace.army.mil/Missions/Regulatory.aspx). The City of Homer must also secure an ADFG SAP if dredged material is placed or its effluent is discharged within the Kachemak Bay CHA, i.e., below 17.3 feet MHW. Table 6 provides a summary of the permitting requirements related to managing dredged material from the Homer SBH and USCG berthing area.

The Corps does not issue itself a Corps Permit for its maintenance dredging activities; however, it is required to comply with the substantive requirements of the aforementioned Act's sections by conducting NEPA and CWA Section 404(b)(1) evaluations and receiving a CWA Section 401

water quality certificate from the State of Alaska. The Corps is also required to comply with applicable State of Alaska permitting requirements, which in the case of dredging activities on the Spit, could involve securing an ADFG SAP if dredged material is placed or its effluent is discharged within the Kachemak Bay CHA, i.e., below 17.3 ft. MHW.

Table 6. Corps Permit and State of Alaska permitting requirements for the Homer Small Boat Harbor and U.S. Coast Guard dredged material management options.

Homer Spit Dredged Material Management Options	Corps Permit Applicability (CWA Section 404, RHA Section 10, MPRSA Section 103)	ADFG Kachemak Bay Critical Habitat Area Special Area Permit	Beneficial Use of Dredged Material Applicability
No Action	No	No	No
Mariner Park	No	No	Yes
Beach Nourishment			
Site 1	Yes (10/404)	Yes	Yes
Site 2	Yes (10/404)	Yes	Yes
Site 3	Yes (10/404)	Yes	Yes
Parking Pads			
Site 1	No	No	Yes
Site 2	No	No	Yes
Open Water Disposal			
Inner Kachemak Bay	Yes (10/404/103)	No	No
Outer Kachemak Bay	Yes (10/404/103)	Yes	No
Lower Cook Inlet	Yes (10/103)	No	No
New Harbor Staging Area	Yes (10/404)	Yes	Yes

6.0 SUMMARY AND CONCLUSIONS

Managing dredged material from the Homer SBH's entrance channel and USCG berthing area has periodically been problematic, especially when, to preserve the physical integrity of the Spit, the City of Homer passed a 1968 ordinance prohibiting the removal of dredged material from the Spit (Appendix B). Consequently, dredged material management sites on the Spit became more and more difficult to find. In 2011, however, the City of Homer amended the subject ordinance to provide for the use and disposal of dredged material originating from the Spit to be available for, among many things, sale as fill material at locations off the Spit (Appendix B). Henceforth, there would appear to be endless options available for managing the disposal and/or placement of material dredged from the Homer SBH's entrance channel and USCG berthing area. However, should it again become necessary to preserve the physical integrity of the Spit by prohibiting dredged material from being removed from the Spit, this report provides options and accompanying analyses for where on and adjacent to the Spit dredged material might be placed and/or disposed of. The level of engineering and environmental analyses in the report is cursory and is not intended to be in sufficient detail to complete dredging-related project planning, environmental assessments [as defined by the Council of Environmental Quality (40 CFR Part 1508, §1508.9)] or Corps Permit applications.

It is important to note that it is Corps policy to dispose of and/or place dredged material in the least costly and environmentally acceptable manner. The Corps also has an established policy to prioritize the use of dredged material for beneficial purposes, including for beach nourishment and erosion control. Under Section 204 of WRDA 1992, the Corps has permanent authority to incorporate the beneficial use of dredged material into operation and management navigation projects like maintenance dredging the Homer SBH.

Repeated dredged material testing and evaluation under the procedures described in the CWA Section 404(b)(1) guidelines for compliance indicate that the material is suitable for beneficial uses and disposal/placment in the marine environment. The subject dredged material is not contaminated and consists primarily of sand and gravel, which makes it valuable for a number applications, such as beach nourishment, recreational land development, habitat development/restoration, and construction fill. Subsequently, the following dredged material management options have a practicable beneficial use for the material dredged from the Homer SBH's entrance channel and USCG berthing area (Table 6): Mariner Park Improvements, Beach Nourishment, Parking Pad Development, New Harbor Staging Area. No beneficial uses were found to be associated with the No Action and Open Water Disposal options.

Mariner Park Improvements: Activities, as described in Section 4.3.4, would not generate any significant adverse environmental consequences. No Corps Permit or ADFG SAP would be required because no dredged material would be placed in waters of the United States or in the Kachemak Bay CHA. Although not proposed, the public has voiced strong sentiment against expanding Mariner Park into the neighboring Mariner Lagoon.

Beach Nourishment: Placing dredged material at one or more of the beach nourishment sites would be a "soft" means of protecting the continually eroding Spit shoreline and Homer Spit Road. There is no maintenance associated with the beach nourishment options, no structural construction costs, and the lifetime capacity is virtually unlimited. An ADFG SAP would be required for all the beach nourishment activities, as the sites are in the Kachemak Bay CHA. A Corps Permit would also be required if the City of Homer pursued beach nourishment activities on its own. The Corps would conduct a CWA 404(b)(1) evaluation for all beach nourishment activities it independently or jointly pursues with the City of Homer.

The three shoreline areas on the Spit's west side considered for beach nourishment are associated with a documented high energy, nearshore environment that is characterized by having a seasonally-migrating sandy beach that continually buries and then uncovers inherently established intertidal and subtidal marine communities. Despite the harsh conditions, tide pools form, having a diverse assemblage of invertebrates and algae, on the landward side of gravel berms and sand bars as the tide recedes.

From an ecological perspective and in most cases, beach nourishment activities are an acceptable method for shoreline protection; however, adverse impacts can result if the activities are not planned and implemented correctly. Therefore, and at a minimum, the following mitigation measures should be considered when developing beach nourishment plans on the west side of the Spit:

- Site BN1-3 is virtually devoid of epifauna and tide pools, is easily accessible, and should be the primary site considered for beach nourishment activities.

- At all sites, dredged material should not be placed in or within 50 feet of tide pools and only be placed at low tide on sand bodies in the mid-tidal zone (approximately between +4 feet and +10 feet MLLW), in a layer not to exceed 2 feet deep.

- If placing dredged material in the mid-tidal zone is determined not feasible, then placing dredged material on the gravel/cobble substrate between the nearshore band of tide pools and the foot of the Spit's rock revetment should be considered.

- Intervals of at least 3 years should exist between successively placing dredged material at any one-beach nourishment site.

Parking Pads Development: Using dredged material to construct parking pads at the identified sites on the Spit would not adversely affect intertidal organisms or other marine fish and wildlife resources (e.g. marine mammals and essential fish habitat) because no dredged material and riprap is expected to be placed below 23.4 feet HTL. However, constructing the parking pads would permanently destroy some of the only remaining natural patches of beach rye grass on the Spit. No Corps Permit or ADFG SAP would be required because no dredged material would be placed in waters of the United States or in the Kachemak Bay CHA.

Future land use planning for the Spit indicates a conflicting land use for the proposed parking areas. Currently the area is zoned "Open Space Recreation." The Homer Spit Comprehensive Plan (Map 5) identifies the area as "conservation and beach access" while Map 6 identifies the area as "future parking." Ultimately, this contradictory land use classification will need resolution by the City of Homer before using dredged material to construct the parking pads.

New Harbor Staging Area: The construction of the 10-acre staging area is closely associated with constructing a new small boat harbor adjacent to and east of the existing small boat harbor. The vast majority of fill material needed to construct the staging area would come from the new harbor's initial dredging of the boat basin and entrance channel. Depending on the timing of "new" harbor dredging and "old" harbor maintenance dredging, material dredged from the existing small boat harbor entrance channel and USCG berthing area could be placed in the new harbor staging area site.

Currently, the Corps and City of Homer have no mutual or independently "approved" plans to construct a new small boat harbor and associated staging area. Constructing a new small boat harbor and staging area would require a Corps Permit (if the City of Homer pursued its construction without Corps funding) and because activities would generate impacts (e.g. a migrating turbidity plume) extending into the Kachemak Bay CHA, an ADFG SAP would likely be required. If the Corps Civil Works program were to become involved with the harbor's planning and possible construction, a lengthy engineering, economic and environmental evaluation would be required to determine the harbor's Federal feasibility. Regardless of who and how the new harbor is constructed, anticipated environmental impacts include: (1) the permanent loss of intertidal and subtidal benthic habitat, (2) permanent changes in circulation

patterns on the east side of the Spit due to modifications in the shoreline and bottom topography, (3) increased turbidity and sedimentation from dredged material disposal and shoreline construction activities, (4) eliminating habitat for juvenile coho salmon, and (5) displacing fish and wildlife resources from using the east side of the Spit.

Open Water Disposal: Currently, no permitted or EPA-approved dredged material disposal sites exist in Lower Cook Inlet or in Kachemak Bay. The Corps considered establishing such sites when preparing the Homer SBH Final O&M EIS (USACE, 1974) and Homer SBH and USCG dock DMMP (USACE, 2007). The Corps expected the type of impacts generated at their sites to be: (1) a temporary degradation of water quality related to increased turbidity and suspended sediments, (2) the burial of shellfish and benthic communities, (3) the temporary displacement of marine mammals and finfish, and (4) the temporary exclusion of commercial and recreational activities from the area as material is disposed of. Ultimately, the cost and time required for collecting site-specific environmental and oceanographic data, in conjunction with the anticipated added cost of transporting dredged material, made selecting any open water disposal alternative impracticable.

A lot of information about Kachemak Bay's and the Spit's fish and wildlife resources has been summarized in a variety of reports (e.g. Dames and Moore, 1981; and, ADFG, 1993) but there still remains a lack of biological information about the proposed open water disposal areas. The Corps does know, however, that the Lower Cook Inlet site coincides with a region heavily utilized by both larvae king crab and pandalid shrimp during the late spring and early summer months, especially nearshore from Anchor Point to the Spit (Galler, 1973) and Kachemak Bay and Lower Cook Inlet is famous for its Pacific halibut fishery. Until more site-specific biological information is available, the proposed sites' environmental feasibility or economic viability cannot be determined.

Regardless of what option(s) might be chosen to manage long term the dredged material from the Harbor SBH and USCG berthing area, the Corps will be required to coordinate its selection with Federal (e.g. NMFS and USFWS), state (e.g. ADFG and ADEC), and local stakeholders (e.g. City of Homer) and comply with a variety of environmental laws, regulations, and Executive Orders, such as the MPRSA, CWA, RHA, ESA and NEPA. Priority should be given to using dredged material benefically and special consideration should be given to ensure that maintenance dredging activities do not adversely impact the fish and wildlife resources of the Kachemalk Bay CHA.

7.0 Cited Literature

Abookire, A.A., J.F. Piatt, and B.L. Norcross. 2001. Juvenile groundfish habitat in Kachemak Bay, Alaska, during late summer. Alaska Fishery Research Bulletin 8(1):45-56.

Adams, P.N., P. Ruggiero, G. Carl Schoch, and G. Gelfenbaum. 2007. Intertidal sand body migration along a megatidal coast, Kachemak Bay, Alaska. Journal of Geophysical Research, Vol. 112, F02007. 19 pp.

Alaska Department of Fish and Game (ADFG). 1993. Kachemak Bay and Fox River Flats Critical Habitat Areas Management Plan. December. 126 pp. + appendices and maps.

Arctic Monitoring Assessment Program (AMAP). 2005. AMAP Assessment 2002: Heavy Metals in the Arctic. AMAP, Oslo, Norway. Xvi + 265 pp. (www.amap.no).

Armonies, W. and K. Reise. 2000. Faunal diversity across a sandy shore. Mar. Ecol. Prog. Ser., Vol. 196. p. 49-57.

Boehlert, G.W. and J.B. Morgan. 1985. Turbidity enhances feeding abilities of larval PacificHerring, *Clupea harengus pallasi*. Hydrobiologia 123:161-170.

Bolam, S.G., H.L. Rees, P. Somerfield, R. Smith, K.R. Clarke, R.M. Warwick, M. Atkins, and E. Garnacho. 2006. Ecological consequences of dredged material disposal in the marine environment: A holistic assessment of activities around the England and Wales coastline. Marine Pollution Bulletin 52 (2006) p. 415-426.

Bolam, S.G. and H.L. Rees. 2003. Minimizing impacts of maintenance dredged material disposal in the coastal environment: a habitat approach. Environmental Management. 09/2003; 32(2):171-188.

Bricelj, V.M., R.E. Malouf, and C. de Quillfeldt. 1984. Growth of juvenile *Mercenaria mercenaria* and the effect of resuspended bottom sediments. Marine Biology, 84:167-173.

City of Homer. 2011. Homer Spit Comprehensive Plan. Prepared by USKH for City of Homer. Adopted November 1, 2011. 46 pp.

Dames & Moore. 1981. Identification of Homer Spit Coastal Development Needs. Homer Spit Coastal Development Program. Prepared for Kenai Peninsula Borough, City of Homer, and Alaska Coastal Management Program. 100+ pp. and appendices.

_____. 1981. Biological Investigations of the Homer Spit Coastal Area. Coastal Development Program. Prepared for Kenai Peninsula Borough, City of Homer, and Alaska Coastal Management Program. 53 pp.

_____. 1977. Dredging Means and Disposal Methods in Eighteen Alaskan Harbors. For Alaska District, U.S. Army Corps of Engineers. 270 pp. + appendices.

Frenzel, S.A. 2002. Priority-Pollutant Trace Elements in Streambed Sediments of the Cook Inlet Basin, AK. 1998-2000. U.S. Department of the Interior, U.S. Geological Survey. Anchorage, AK.

Galler, S.R. 1973. Letter of Comment. U.S. Department of Commerce, Deputy Assistant Secretary for Environmental Affairs. Letter to U.S. Army Corps of Engineers, Alaska District, dated May 17, 1973.

Gregory, R.S. and T.G. Northcote. 1993. Surface, planktonic, and benthic foraging by juvenile Chinook salmon, *Oncorhynchus tshawytscha*, in turbid laboratory conditions. Canaadian Journal of Fisheries and Aquatic Sciences 50:233-240.

Hartwell, S.I., A.D. Apeti, W.L. Claflin, W.E. Johnson, and L.K. Kimbrough. 2009. Sediment Quality Triad Assessment in Kachemak Bay: Characterization of Soft Bottom Benthic Habitats and Contaminant Bioeffects Assessment. NOAA Technical Memorandum NOS NCCOS 104. 170 pp.

Hirsch, N.D., L.H. DiSalvo, and R. Peddicord. 1978. Effects of Dredging and Disposal on Aquatic Organisms. Technical Report DS-78-5, August 1978, U.S. Army Engineer Waterways Experiment Station, Corps of Engineers, Vicksburg, MS. 41 pp.

Kachemak Bay Research Reserve. 2003. A Site Profile of the Kachemak Bay Research Reserve: A Unit of the National Estuarine Research Reserve System. Compiled by C. Field and C. Walker. Kachemak Bay Research Reserve, Homer, Alaska. 135 pp.

Lee, D.C., D.E. Erikson, W.B. Driskell and M.S. Treesh. 1981. Biological Investigations of Homer Spit Coastal Area. Prepared for Kenai Peninsula Borough, City of Homer and Alaska Coastal Management Program. By Dames & Moore. 138 pp. + appendices.

Lees, D.C. and J.P. Houghton. 1977. Reconnaissance of the intertidal and shallow subtidal biotic assemblages in Lower Cook Inlet – Final report for NOAA/OCSEAP by Dames and Moore. 315 pp.

Lee, D.C., J.P. Houghton, D.E. Erikson, W.B. Driskell and D.E. Boettcher. 1980. Ecological Studies of Intertidal and Shallow Subtidal Habitats in Lower Cook Inlet, Alaska. Final Report. Prepared by Dames & Moore for National Oceanic and Atmospheric Administration. Job No. 6797-012-20. May. 406 pp.

Maguire Group Inc. 2005. Indentification and Designation of a Buzzards Bay Disposal Site for Suitable Dredged Material. Draft Environmental Impact Report. Prepared for: Massachusetts Office of Coastal Zone Management. November 15, 2005.

Menn, I., C. Junghans and K. Reise. 2003. Buried Alive: Effects of beach nourishment on the infauna of an erosive shore in the North Sea. Senckenbergiana Maritima (2003)32: p. 125-145.

NOAA (National Oceanic and Atmospheric Administration). 1977. Environmental Studies of Kachemak Bay and Lower Cook Inlet. Volumes I – XII. Outer Continental Shelf Environmental Assessment Program. 1977.

Nelson, D. A., and Pullen, E. J. 1990. "Environmental Considerations in Using Beach Nourishment for Dredged Material Placement," pp. 113-128. In: R. L. Lazor and R. Medina (eds.) Beneficial Uses of Dredged Material. Technical Report D-90-3, U.S. Army Engineer Research Waterways Experiment Station, Vicksburg, MS.

Nelson, W.G. 1993. Beach restoration in the southeastern US: environmental effects and biological monitoring. Ocean Coastal Management. 19: 157-182.

Oliver. J.S., P.N. Slattery, L.W. Hulberg, and J.W. Nybakken. 1977. Patterns of Succession in Benthic Infaunal Communities Following Dredging and Dredged Material Disposal in Monterey Bay. Prepared for Office, Chief of Engineers, U.S. Army, Washington, D.C.. U.S. Army Engineer Waterways Experiment Station, Vicksburg, MS. Dredge Material Research Program Technical Report D-77-27, October. 186 pp.

Ruggiero, P., P. N. Adams, and J. A. Warrick. 2007. Mixed sediment beach processes: Kachemak Bay, Alaska. ASCE 2007, Coastal Sediments '07. 14 pp.

USACE (U.S. Army Corps of Engineers). 2013. Memorandum. Homer Harbor Channel Realignment Sediment Sampling, Homer, Alaska (13-046). Alaska District. Anchorage, Alaska. 19 June 2013. 5 pp. + attachments.

_____. 2012. Memorandum. Homer Harbor Sediment and Stockpile Characterization, Homer, Alaska (11-059). Alaska District. Anchorage, Alaska. 24 January 2012. 7 pp. + attachments.

_____. 2007. Dredged Material Management Plan, Environmental Assessment and Finding of No Significant Impact for the Homer SBH and USCG Dock, Homer, Alaska. Alaska District. Anchorage, Alaska. August. 42 pp. + appendices.

_____. 2002. Memorandum. Chemical Data Report. Homer Harbor Dredge Management Site Investigation, Homer, Alaska. Alaska District. Anchorage, Alaska. 4 November 2002. 6 pp. + attachments.

_____. 2000. Planning Guidance Notebook. Engineer Regulation No. 1105-2-100, 22 Apr 2000, Appendix E – Civil Works Programs. Section E-15, page E-77.

_____. 1981. Detailed Project Report and Final Environmental Impact Statement. Proposed Navigation Improvements (Small Boat Harbor Expansion). Homer Harbor, Homer, Alaska. Alaska District. Anchorage, Alaska. February. 51 pp. + appendices.

_____. 1974. Final Environmental Impact Statement. Operation and Maintenance of the Homer Small Boat Harbor, Homer, Alaska. Alaska District. Anchorage, Alaska. March. 54 pp. + appendices.

_____. 1972. The Cook Inlet Environment: A Background Study of Available Knowledge. Alaska District. Anchorage, Alaska. August. 160 pp.

USEPA (U.S. Environmental Protection Agency). 2007. The Role of the Federal Standards in the Beneficial Use of Dredged Material from U.S. Army Corps of Engineers New and Maintenance Navigation Projects. Oceans and Coastal Protection Division, Office of Water, Washington, D.C. October. EPA842-B-07-002

_____. 1991. Evaluation of Dredged Material Proposed for Ocean Disposal. Testing Manual. EPA Office of Marine and Estuarine Protection, Wahington, D.C. and Department of the Army, U.S. Army Corps of Engineers, Washington, D.C., 186 pp. February 1991.

USEPA (U.S. Environmental Protection Agency)/USACE (U.S. Army Corps of Engineers). 2004. Evaluating Environmental Effects of Dredged Material Management Alternatives – A Technical Framework. EPA842-B-92-008.

U.S. Geological Survey. 2001. Distribution of Arsenic in Water and Streambed Sediments, Cook Inlet Basin, AK. USGS Fact Sheet FS-083-01. September 2001.

Woodward-Clyde Consultants. 1980. Homer Spit littoral drift studies. Prepared for U.S. Army Corps of Engineers, Alaska District. 74 pp.

Appendix A

Homer Small Boat Harbor and U.S. Coast Guard Berthing Area Dredged Material Management Guidance

2012 Biological Field Investigation

View under the Homer Port deep water dock.

Homer Small Boat Harbor and U.S. Coast Guard Berthing Area Dredged Material Management Guidance

2012 Biological Field Investigation

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INTRODUCTION

Maintenance dredging material is currently obtained from the Homer Small Boat Harbor and U.S. Coast Guard dock and after being dewatered, it is stockpiled in an area west of the harbor's mooring basin for future use.

Biological field investigations were conducted at nine sites around the Homer Spit, including the existing stockpile, for the purpose of establishing an environmental baseline from which an assessment of potential adverse or beneficial impacts could be conducted should any one site or more sites be proposed by the U.S. Army Corps of Engineers, Alaska District, Civil Works, (Corps) and/or City of Homer to receive dredged material. The nine sites are: (1) Mariner Park; (2) Beach Nourishment Site 1; (3) Beach Nourishment Site 2; (4) Beach Nourishment Site 3; (5) Parking Pad 1; (6) Parking Pad 2; (7) In-water 1 – Outside Homer Spit; (8) In-water 2 – Inside Homer Spit; and (9) New Harbor Staging Area (Figure 1).

Figure 1. Biological field investigations at nine potential sites to receive dredged material, Homer Spit, AK.

FIELD METHODS

Land-based intertidal transects and boat-based subtidal video surveys and bottom sampling were conducted between June 4 and June 8, 2012, by biologists Wayne Crayton and Chris Hoffman (U.S. Army Corps of Engineers, Alaska District, Environmental Resources Section). Intertidal transects between 300 and 600 feet were established between the high tide line and water's edge. Substrate and biological characteristics along each transect were documented textually and electronically with the use of a digital camera and video recorder. Subtidal information at the offshore sites was collected with the use of a bottom sampler and to a limited degree with a Remotely Operated Vehicle. Bottom sample locations were documented using a GPS.

EXISTING DREDGED MATERIAL STOCKPILE

North of Harbor Basin

Location

The coordinates for this location are 59°36'25.89" N, 151°26'00.88" W.

Physical Surroundings and Features

This city-owned 1.2 acre upland site is surrounded by harbor access roads and existing commercial establishments (Figure 2). To the west is a public campground and to the east are various vendors, parking areas, and areas designated by the City of Homer for future commercial development (Figure 3). The material dredged from the harbor and dock area is a mixed composition of course sand, gravel, and small stone and cobble (Figure 4). Observed were members of the public, including children, playing among the piles of dredged material. Also observed were dump trucks being loaded with purchased dredged material to be hauled to construction sites off the Homer Spit (Figure 5).

Biological Features

This site has virtually no biological features to describe, as the area is comprised of recently stored dewatered piles of dredged material from the harbor and nearby U.S. Coast Guard berthing area. The periodic removal of dredged material using a frontend loader and dump truck heavily disturb the piles not affording much time for vegetation to become established. It was noted, however, that "older" undisturbed piles of dredged material did have sparse patches of vegetation (e.g. beach rye grass and assorted invasive plant species) growing upon them. The only wildlife observed using the stockpile area were gulls /standing/sitting on top of the piles.

Figure 2. Existing dredged material stockpile area, Homer Spit, AK.

Figure 3. Stockpiled dredged material west of the Homer Small Boat Harbor.

Figure 4. Dredged material composition of sand, gravel and small cobble obtained from dredging Homer Small Boat Harbor.

Figure 5. Heavy machinery loading dump truck with purchased stockpiled dredged material.

POTENTIAL DREDGED MATERIAL MANAGEMENT SITES

Mariner Park

Location

The coordinates for Mariner Park are 59°37'55.24" N, 151°29'42.18" W.

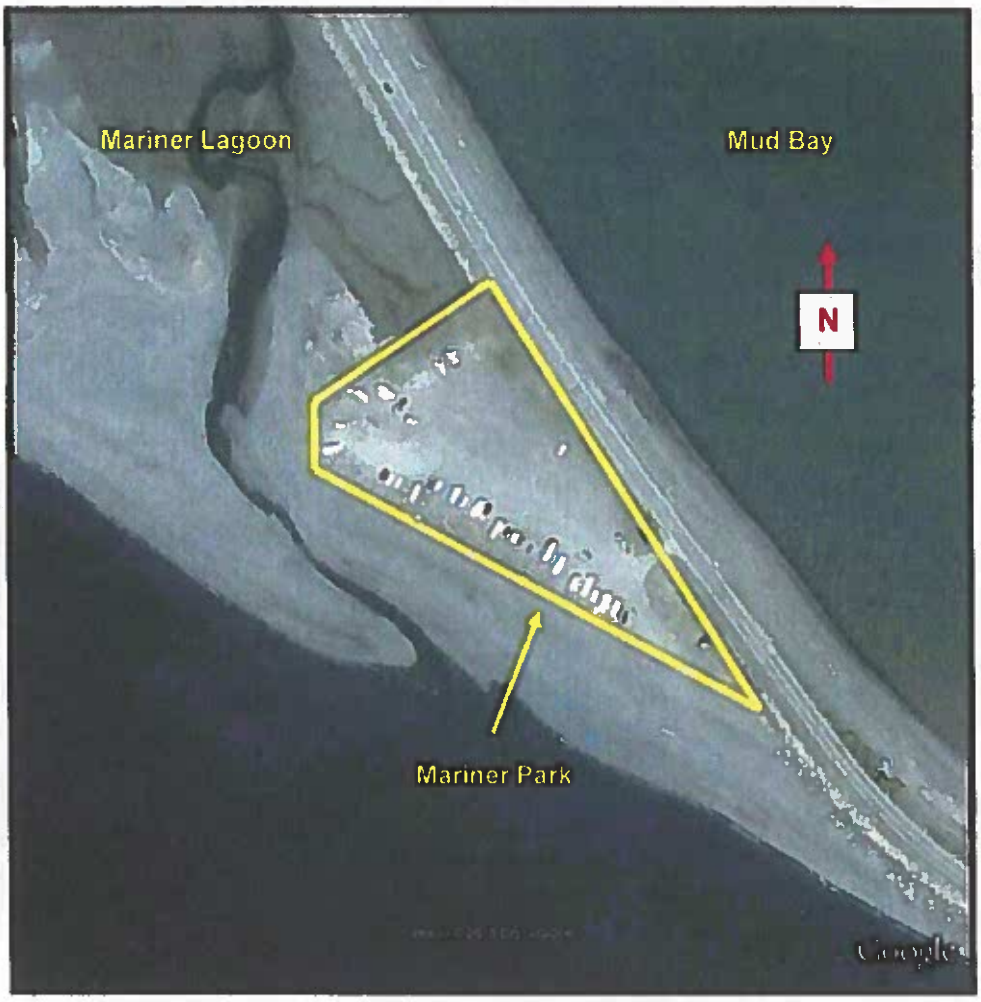


Figure 6. Potential dredged material management site at Mariner Park, Homer Spit, AK.

Physical Surroundings and Features

Located on the north end of the Spit at its base, this approximately 100-acre multi-use, city-owned park is a popular camping spot which attracts local residents and tourists alike. The three-acre public parking and camping area, above the mean high tide line of +23.4 feet mean lower low water (MLLW), is the potential site to receive dredged material (Figure 6). The adjacent Mud Bay and Mariner Lagoon areas are part of the Western Hemisphere Shorebird Reserve Network, both of which are in the State of Alaska Kachemak Bay Critical Habitat Area. The City

of Homer has identified several recreational and safety enhancement projects for the park, short of placing additional fill material into Mariner Lagoon, such as moving the park entrance to increase sight distances, improving the parking pad, and constructing permanent restrooms.

Biological Features

Because of its heavy recreational and vehicle use, the parking pad area potentially used for dredged material management is lacking quality wildlife habitat. Beach-associated vegetation has become firmly established on the area's eastside and north side berms (Figure 7). Only scattered patches of vegetation have become established on the west side (i.e. Cook Inlet side) of the parking pad because of heavy human use to access the shoreline and tide flats. The only wildlife observed using the vegetated areas were passerine birds and shorebirds.

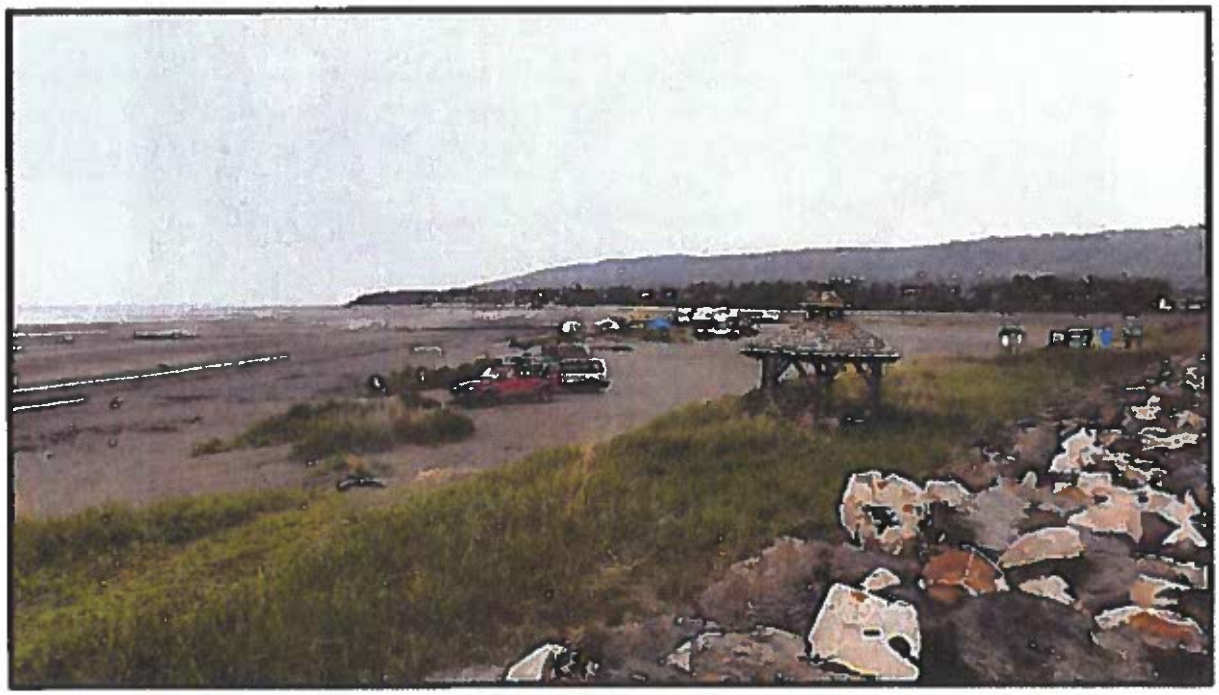


Figure 7. Northwest view of Mariner Park parking area, Homer Spit, AK.

Beach Nourishment Sites

Three nearshore areas (BN 1, BN 2 and BN 3) have been identified as potential beach nourishment (Figure 8). The areas were chosen in hopes that the deposited material would: (1) nourish beach areas prone to erosion from repeatedly being subjected to heavy storm surges, and (2) maintain the structural integrity of adjacent armor rock shoreline protection features.

Figure 8. Three potential beach nourishment sites for receiving material dredged from the Homer Small Boat Harbor and U.S. Coast Guard dock.

Beach Nourishment Site BN 1

Physical Surroundings and Features

This area extends approximately 2,900 feet along shore from Mariner Park southeast and adjacent to a rock revetment. The rock revetment protects the inshore half of the Homer Spit Road from shoreline erosive forces. Offshore extends an expansive sandy/muddy tidal flat pocketed with tidal drainages and tide pools. Also along this stretch and extending offshore are a series of dilapidated wood pilings historically associated with groins constructed in an attempt to control shoreline erosion and accumulate sediment (Figure 9).

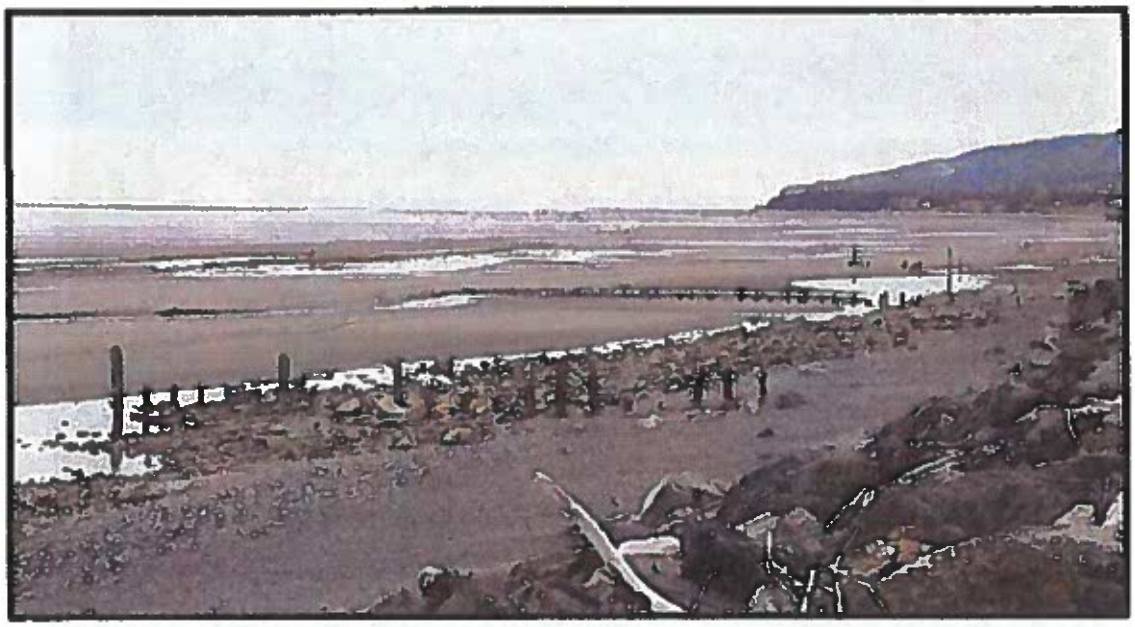


Figure 9. Homer Spit beach nourishment area BN 1 illustrating the locations of historically constructed groins and expansive tidal flats features.

Biological Features

Three intertidal transects (BN 1-1, BN 1-2, and BN 1-3) were established in this area (Figure 10). After conducting a reconnaissance survey of the area, transects were positioned in areas that would maximize the amount of biological information collected.

Transect BN 1-1

Location: 59°37'39.45" N, 151°28'54.96" W
Time: 10:46 am, June 6, 2012
Tide stage: Low tide at 10:40 am, -5.3 feet MLLW
Observations along transect (Figure 11):

- 0 to 48 ft. – clean surface of sand/gravel mix from toe of armor rock.
- 48 to 84 ft. – heavily encrusted rocks with barnacles and blue mussels. Some Fucus sp. and other brown algae species, amphipods and a wide variety of snails (Figures 12 and 13).
- 84 to 110 ft. – sandy area with scattered boulders, tidal drainage leading to tide pool.
- 110 to 232 ft. – rippled sandy surface collecting detritus (coal, shells, algae).
- 232 to 405 ft. – smooth sandy surface void of epifauna then 2 ft. drop to tide pool.
- 405 to 549 ft. – tidal drainage with rocks and sand mix, no algae or epifauna, clean bottom.
- 549 to 600 ft. – edge of tide pool to end, rippled surface sand bar. Water line beyond end of transect.

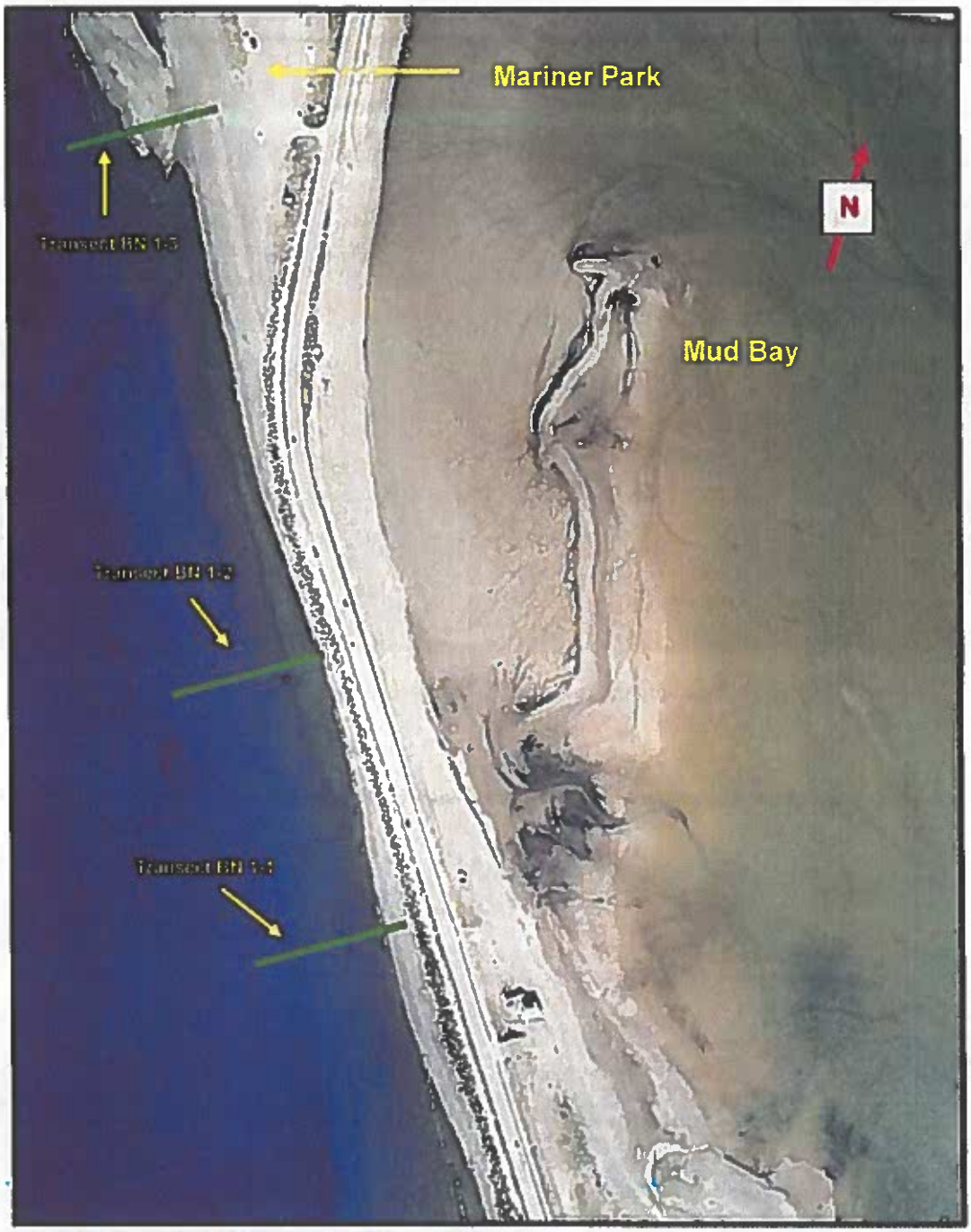


Figure 10. Locations of intertidal transects at Beach Nourishment Site 1, Homer Spit, AK.

Figure 11. Beach nourishment area Transect BN 1-1, first 300 feet.

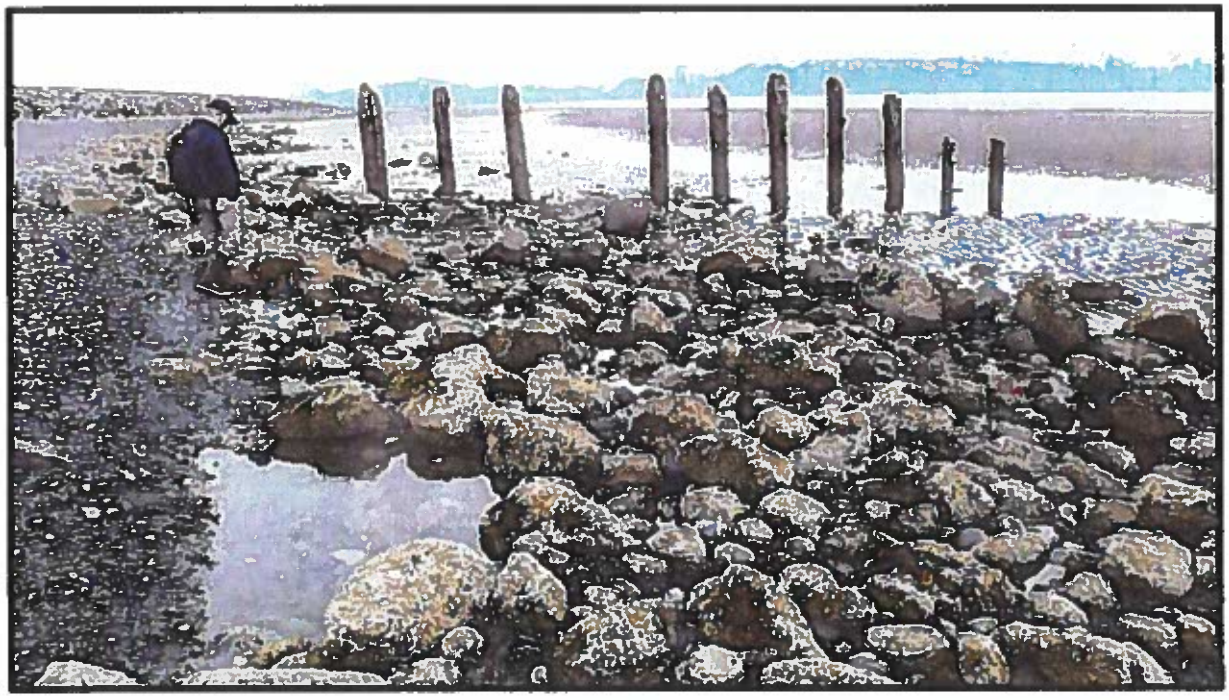


Figure 12. Beach nourishment area Transect BN 1-1, 48 to 84 foot segment.

Figure 13. Beach nourishment area Transect BN 1-1, epifauna assemblage found in 48 to 84 foot segment.

Transect BN 1-2

Location: 59°37'44.29" N, 151°29'14.02" W
Time: 11:24 am, June 6, 2012
Tide stage: Low tide at 10:40 am, -5.3 feet MLLW
Observations along transect (Figure 14):

- 0 to 28 ft. – clean surface of sand/gravel/cobble mix from toe of armor rock.
- 28 to 88 ft. – silt covered cobble, some barnacles, filamentous green and brown algae, small standing pool before edge of sand bar.
- 88 to 240 ft. – sandy area with scattered boulders, no sign of epi-and infauna.
- 240 to 300 ft. – cobbles with some barnacles, shell debris, amphipods under rocks, little pooled water, no sign of polychaetes
- 300 to 372 ft. – patch of cobble on sand substrate in tidal drainage, algae detritus build up.
- 372 to 541 ft. – large tide pool and tidal drainage, cobble reef with Fucus sp., ribbon kelp, Ulva sp., and filamentous brown alage. Small crabs, limpets, chitons, worm casings, amphipods, blue mussels, anemones, and barnacles (Figure 15).
- 541 to 600 ft. – sand bar with a clean surface, heavily rippled and extending out into the water, no sign of epi- and infauna (Figure 16).

Figure 14. Beach nourishment area Transect BN 1-2, first 300 feet of 600 foot long transect.

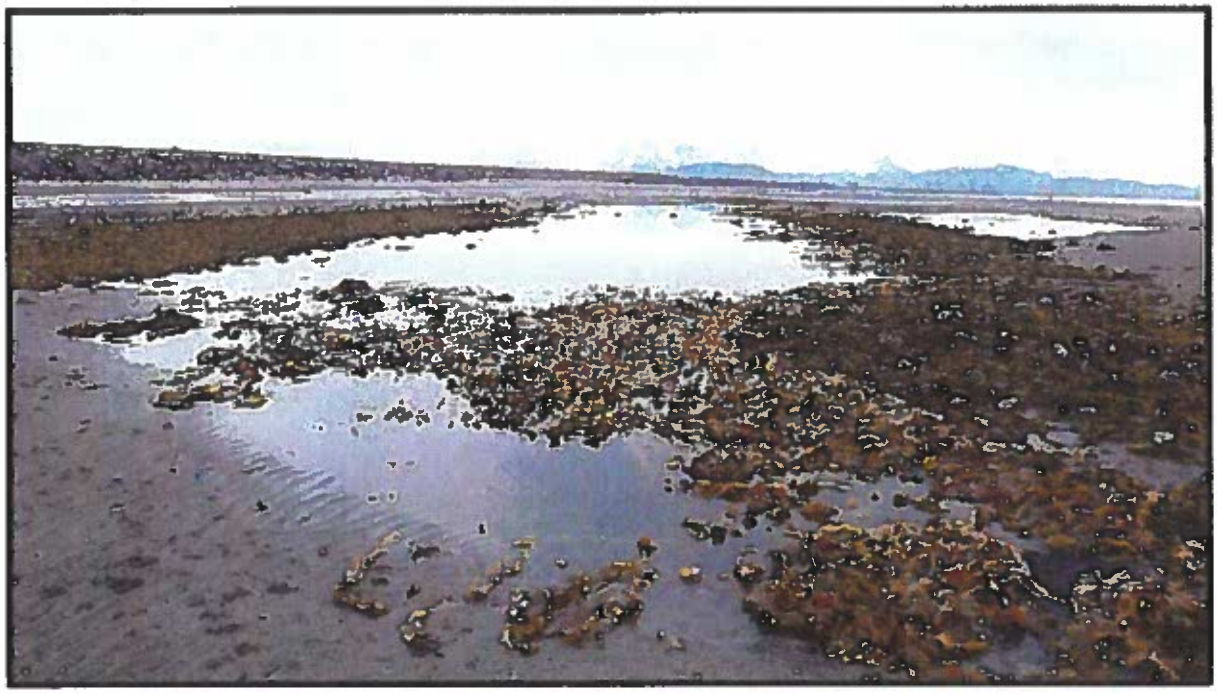


Figure 15. Beach nourishment area Transect BN 1-2, 372 to 541 foot segment illustrating tide pool assemblage.

Figure 16. Beach nourishment area Transect BN 1-2, last 300 feet of 600 foot long transect.

Transect BN 1-3

Location: 59°37'52.75" N, 151°29'42.17" W
Time: 12:14 PM, June 6, 2012
Tide stage: Low tide at 10:40 am, -5.3 feet MLLW
Observations along transect (Figure 17):

- 0 to 74 ft. – sandy substrate transitioning to a gravelly-coarse sand mix. No epi- or infauna observed (Figure 18).
- 74 to 106 ft. – begin gravelly slope down to fine sand/gravel mix substrate. No epi- or infauna observed.
- 106 to 120 ft. – sandy bank of tidal slough clean of epi- or infauna.
- 120 to 229 ft. – an elevated area of small cobble, sand, and gravel. No epi- or infauna observed.
- 229 to 449 ft. – hard packed, smooth sandy surface with scattered cobble.
- 449 to 490 ft. – sloping terrain, mostly coarse sand with some gravel.
- 490 to 600 ft. – heavily cobble/gravel mix on a flat area. Barnacle scars on rock surfaces with some live barnacles. Some algal detritus with amphipods mingled within it and under rocks. End of transect in a tidal drainage (Figure 19).

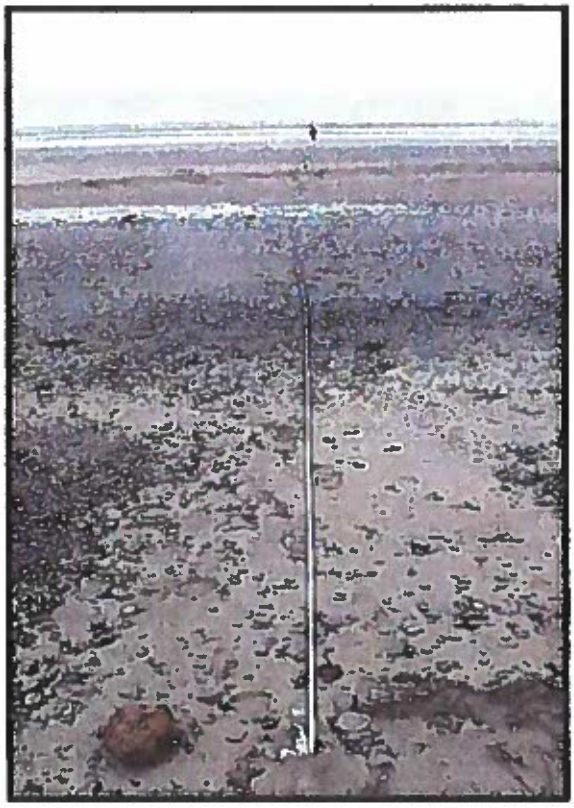


Figure 17. Beach nourishment area Transect BN 1-3, first 300 feet of 600 foot long transect.

Figure 18. Beach nourishment area Transect BN 1-3, 0 -74 ft. segment, no epi- or infauna.

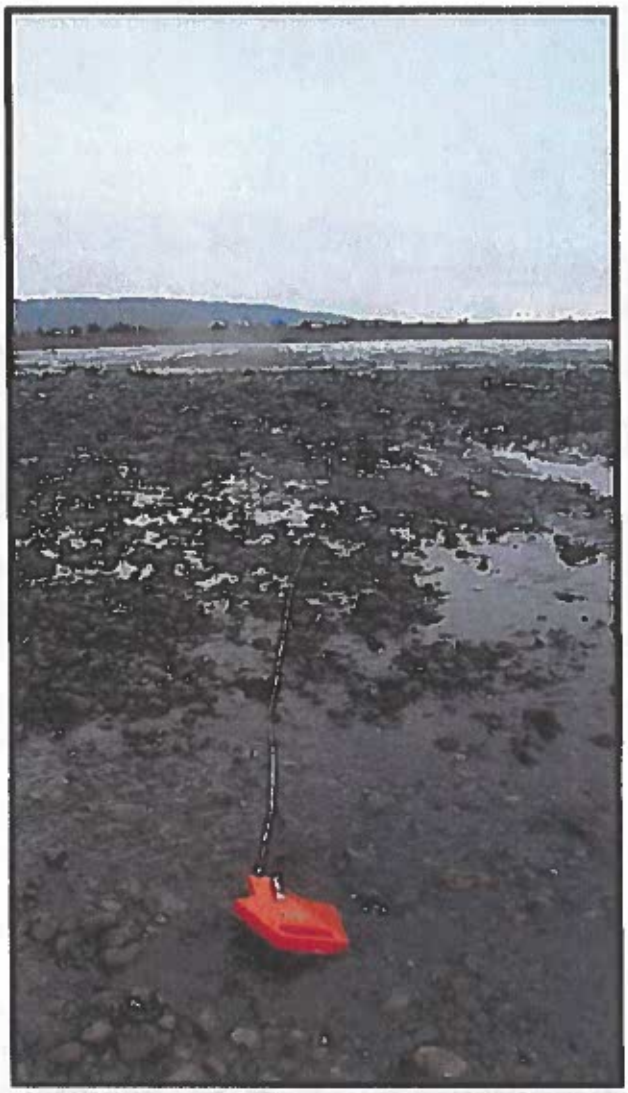


Figure 19. Beach nourishment area Transect BN 1-3, last 300 feet of 600 foot long segment.

Beach Nourishment Site BN 2

Physical Surroundings and Features

This area extends approximately 1,400 feet along a rock revetment on the west side of Homer Spit (Figures 20 and 21). The 1,130 foot long rock revetment was constructed by the Corps in 1994 to protect a State of Alaska-constructed 1,040 foot long cantilevered steel sheet pile wall that was constructed in 1980 and subsequently repaired in 1982 after a storm surge event overtopped it (Figure 22). Offshore extends an expansive sandy/muddy tidal flat beyond a narrow band of medium sized rock, cobble and gravel pocketed with tide pools.

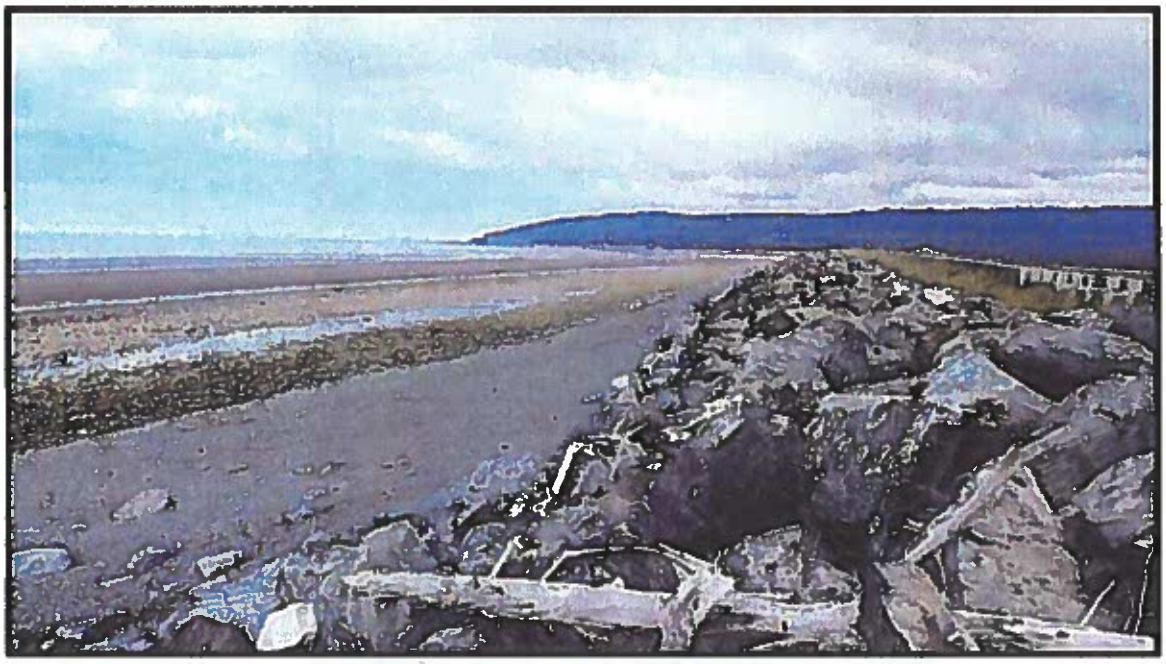


Figure 20. Homer Spit beach nourishment area BN 2, view to northwest, illustrating the rock revetment and offshore topography. Note transition from toe of revetment to gravel beach to band of cobble/tide pools to sand/mud flats.

Figure 21. Homer Spit beach nourishment area BN 2, view to southeast, illustrating the rock revetment and offshore topography. Note transition from toe of revetment to gravel beach to band of cobble/tide pools to sand/mud flats.

Figure 22. Homer Spit beach nourishment area BN 2, view illustrating rock revetment placement protecting the face of steel sheet pile and Homer Spit Road.

Biological Features

Because of the uniform terrain alongshore and offshore from the toe of the rock revetment, only one 600 foot long transect (BN 2-1) was necessary to characterize the intertidal community of organisms and substrate (Figure 23).

Transect BN 2-1

Location: 59°37'16.89" N, 151°27'54.40" W
Time: 10:20 am, June 7, 2012
Tide stage: Low tide at 11:27 am, -4.3 feet MLLW
Observations along transect:

- 0 to 35 ft. – from toe of revetment. Sloping profile. Gravel/coarse sand mix. No epi/infauna.
- 35 to 76 ft. – band of medium cobble covered with silt and non-filamentous green algae which gave the band a green hue (Figure 24). Many amphipods found under the cobble.
- 76 to 151 ft. – a wide sandy-substrate tide pool about 1 foot deep with many brown and green algal species (*Fucus* sp., *Ulva* sp., ribbon kelp, etc.) attached to scattered medium size cobble (Figures 25 and 26). Blue mussels, acorn barnacles, amphipods, sponges predominate (Figure 27).
- 151 to 287 ft. – Not a tide pool but heavily cobbled band of substrate with pockets of water draining from the tide pool towards a tidal drainage channel. Same type of organism assemblage as in the neighboring tide pool except having a more dense barnacle population along with wormholes, shell debris and filamentous green algae.

• 287 to 314 ft. – tidal drainage channel extending from edge of cobble field to beginning of upslope to sand bar/mud flat (Figure 28).
• 314 to 600 ft. – sand bar/mud flat to end of transect, some detritus on surface but essentially void of organisms with exception of some worm holes (Figure 29).

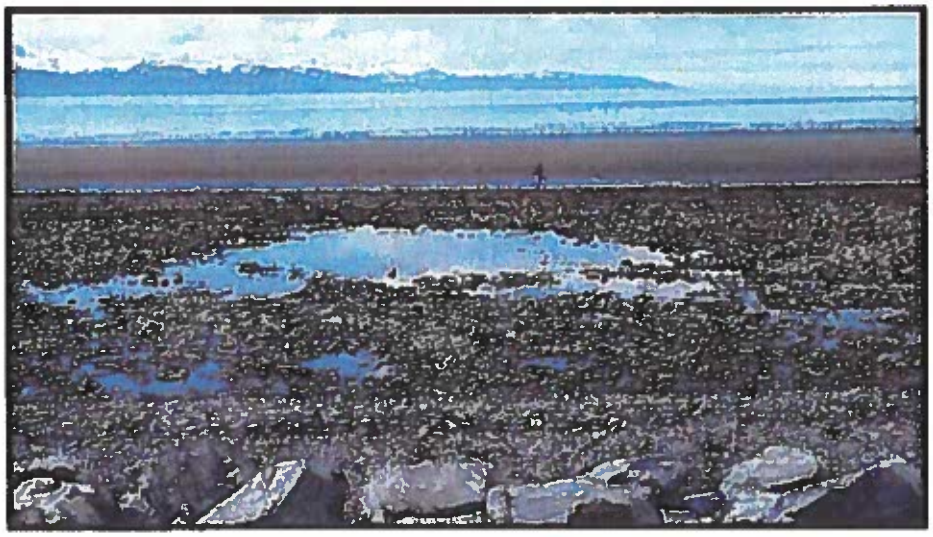


Figure 23. Homer Spit beach nourishment area BN 2, view of first 300 feet of transect through tide pool.

Figure 24. Homer Spit beach nourishment area BN 2, 35-to-76 foot segment showing green algal hue on cobble.

Figure 25. Homer Spit beach nourishment area BN 2, algal assemblage in 76-to-151 foot tide pool segment.

Figure 26. Homer Spit beach nourishment area BN 2, ribbon kelp and algal assemblage in 76-to-151 foot tide pool segment.

Figure 27. Homer Spit beach nourishment area BN 2, epi/infauna assemblage in 76-to-151 foot tide pool segment.

Figure 28. Homer Spit beach nourishment area BN 2, tidal drainage channel between 287-to-314 foot transect segment.

Figure 29. Homer Spit beach nourishment area BN 2, view at end of 600 foot long transect on sand bar/mud flat back towards rock revetment where transect began.

Beach Nourishment Site BR 3

Physical Surroundings and Features

This area extends approximately 550 feet along the outer Kachemak Bay shoreline of Homer Spit, opposite the Heritage RV Park. The site begins near the southern end of a 3,700 foot long rock revetment and 500 foot long rock transition area constructed by the Corps in 1998 (Figure 30), and ends in an area of shoreline without any constructed shoreline protection measures (Figure 31). Beginning in this area the beaches are wide enough to allow recreational camping and RV areas to become established along the shoreline.

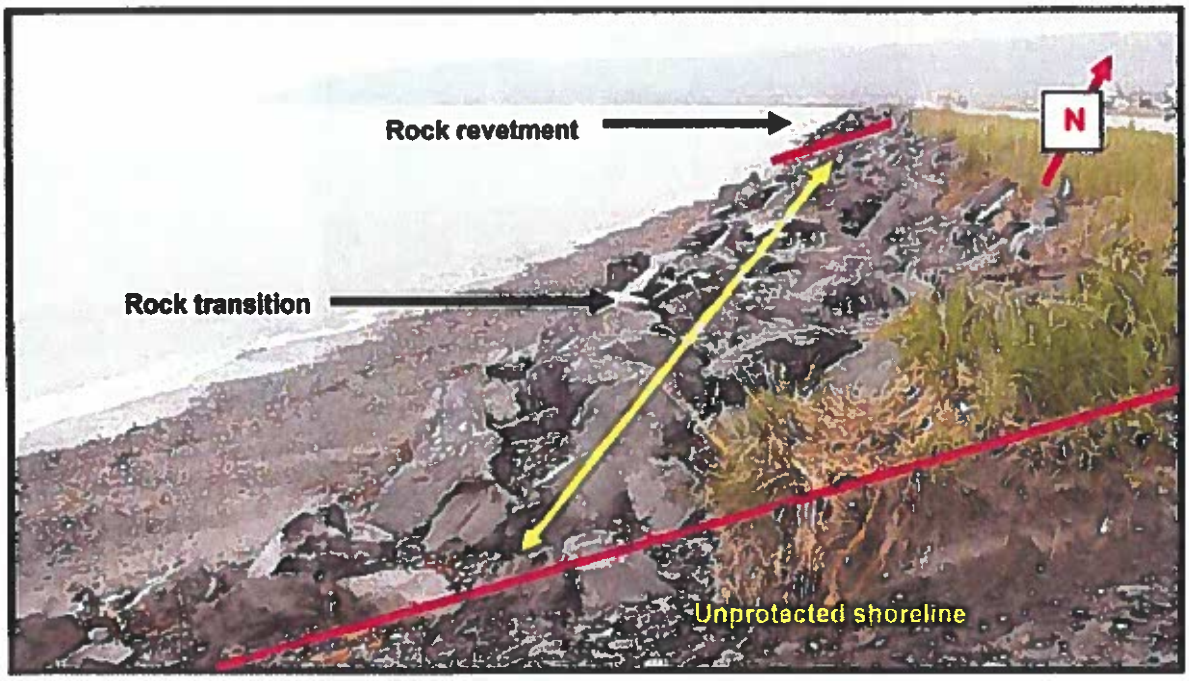


Figure 30. Homer Spit beach nourishment area BN 3.

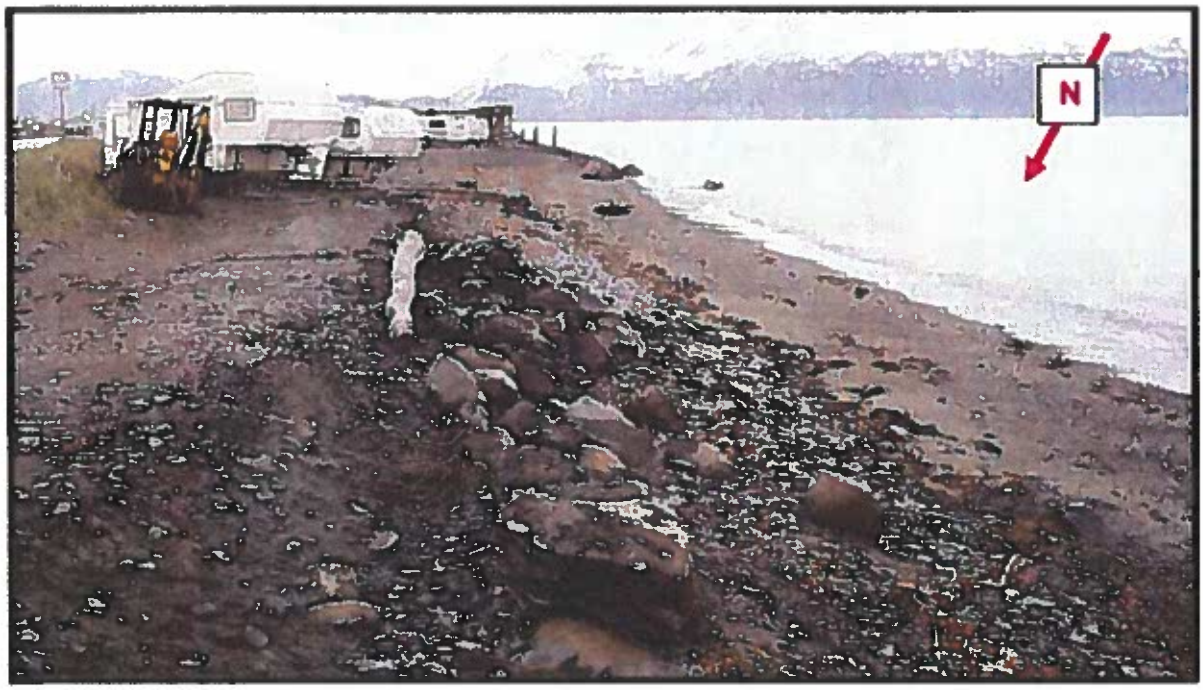


Figure 31. Homer Spit beach nourishment area BN 3, unprotected shoreline extending beyond the rock revetment towards the end of the spit.

A very noticeable geotechnical feature at the top of the rock transition is the eroding shoulder of the Homer Spit Road (Figure 32). Other areas at the top of the rock transition area are slumping causing clumps of grassy vegetation to erode as well (Figure 33).

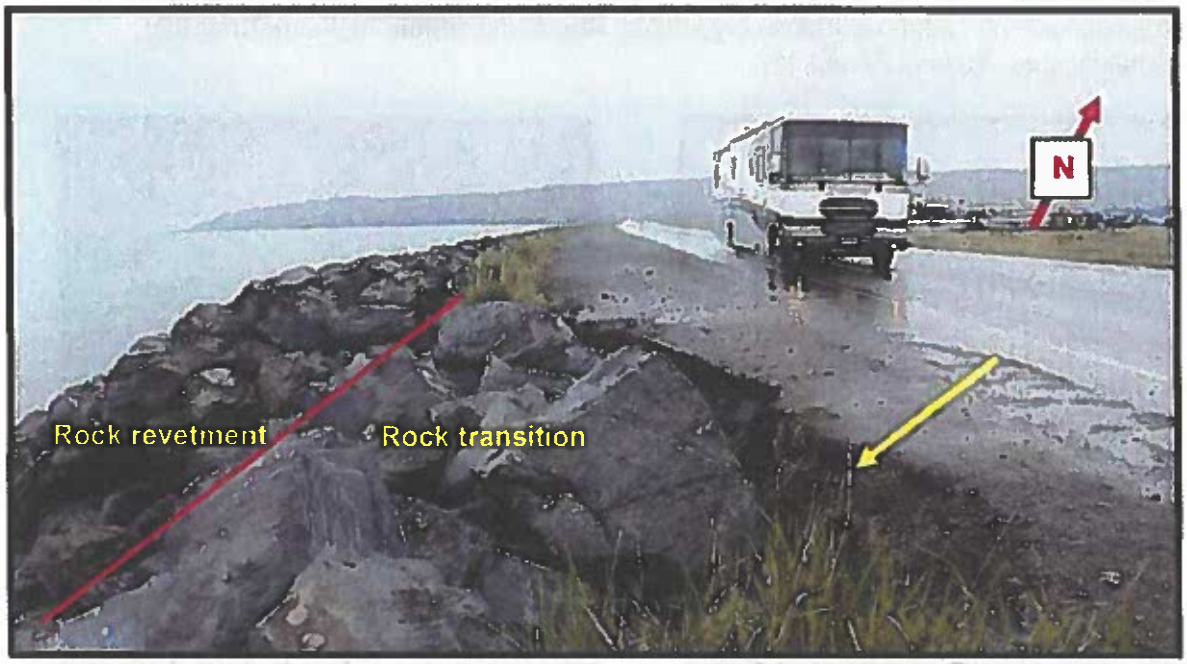


Figure 32. Homer Spit beach nourishment area BN 3, eroding shoulder (yellow arrow) of the Homer Spit Road adjacent to the rock transition area.

Figure 33. Homer Spit beach nourishment area BN 3, slumping soil at top of the rock transition area and subsequent erosion.

Biological Features

This site was visited on June 6, 2012, at 4:39 pm; high tide was at 5:16 pm, +19.6 feet. No transect was necessary at this site because: (1) the areas proposed for beach nourishment are primarily at the base of the rock revetments and unprotected shoreline just to the south of the revetments, and (2) no epi- or infauna organisms were found within the footprint of the nourishment area (Figures 34 and 35).

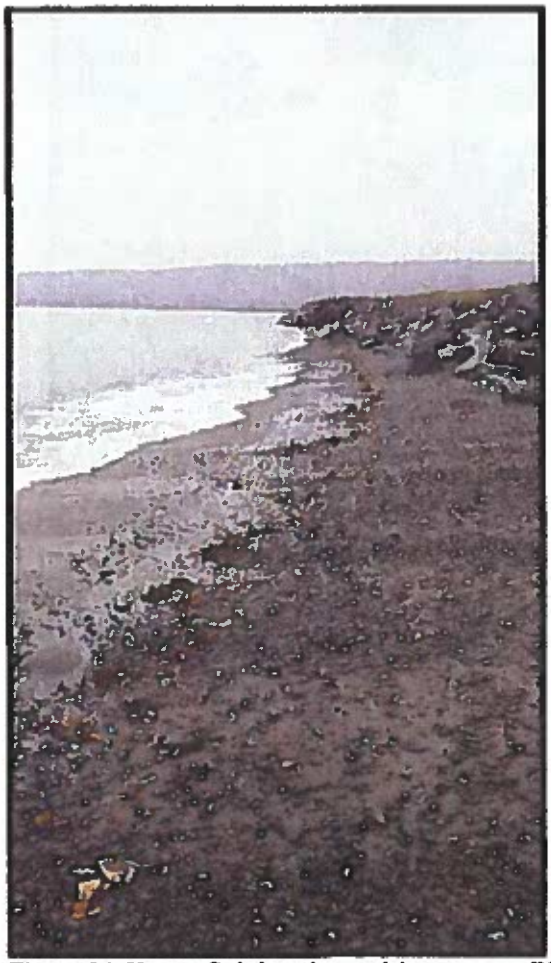


Figure 34. Homer Spit beach nourishment area BN 3.

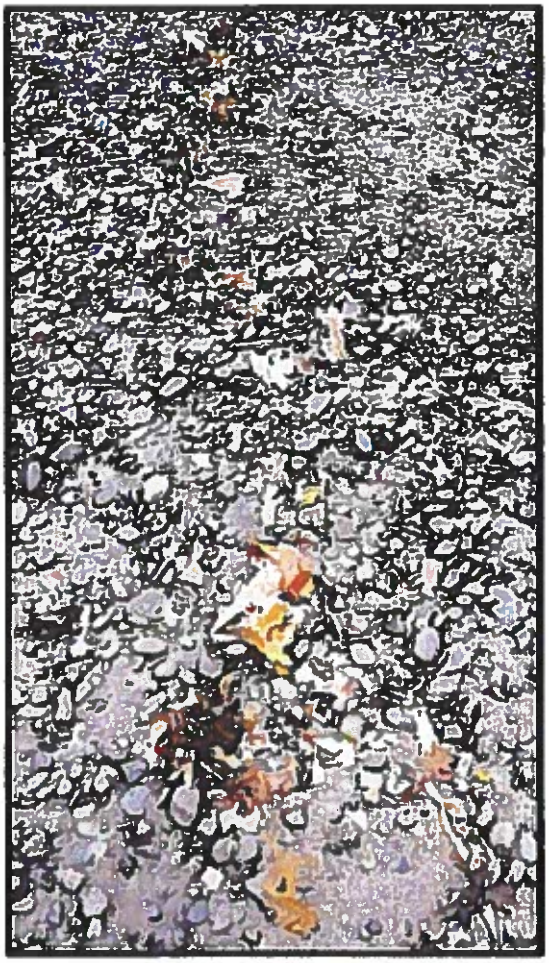


Figure 35. Homer Spit beach nourishment area BN 3. Substrate composed of coarse sand and gravel.

Available historical photographs were used to determine what type of substrate existed offshore from the beach nourishment site. Apparently the alongshore movement of bottom sediment periodically cover and expose bands of cobble/gravel habitat; however, expansive sandy tidal flats predominate just offshore from this beach nourishment site (Figures 36 and 37).

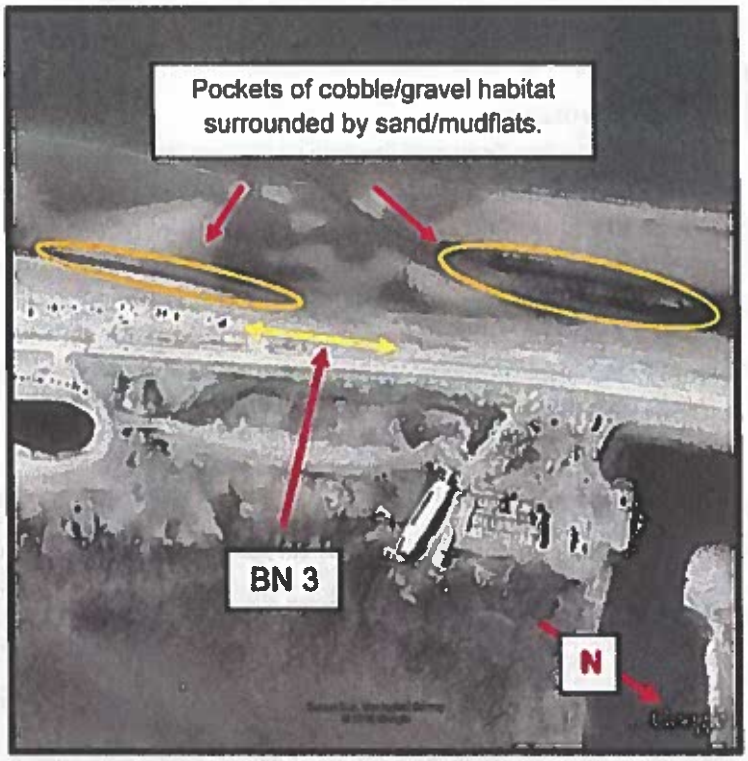


Figure 36. Homer Spit beach nourishment area BN 3 in 1996.

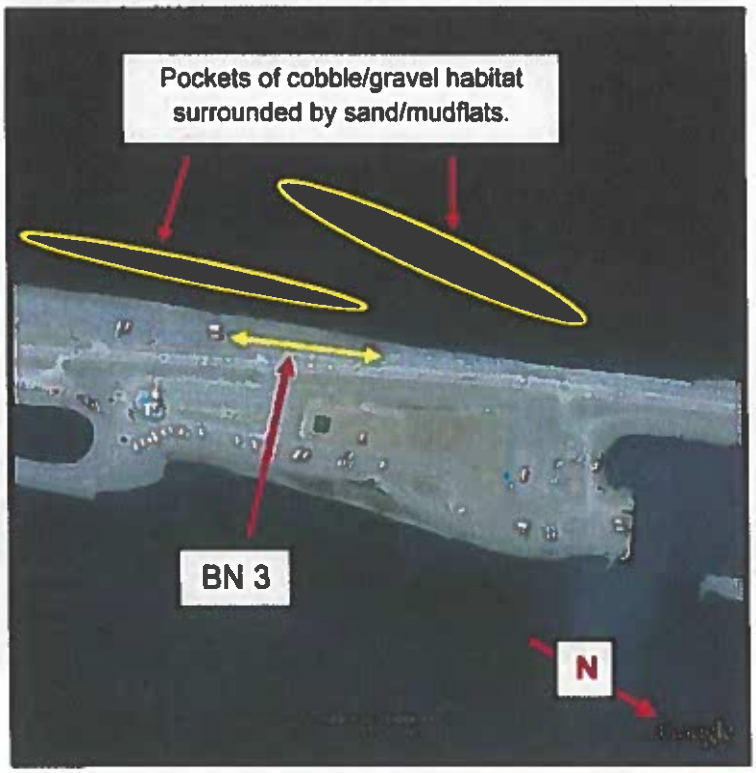


Figure 37. Homer Spit beach nourishment area BN 3 in 2006.

Parking Pad Development Sites

Parking Pad 1

Physical Surroundings and Features

This approximately 1.2 acre area extends approximately 350 feet between an existing parking lot to the southeast, an accumulation of pile-supported commercial establishments to the northwest, and immediately adjacent to a row of parking spaces along the Homer Spit Road (Figure 38). The parking pad's width would extend seaward approximately 50 feet from the edge of the existing roadside parking area. Except for the seaward shoreline of the area, the entire area is surrounded by harbor-related commercial developments and parking areas. The parking area to the southeast was previously constructed using fill material, as would the new parking area. The substrate is primarily beach gravel covered with a sandy vegetated mat.

Figure 38. Parking pad development Site #1 on Homer Spit, Alaska.

Biological Features

This site was visited on June 5, 2012, at 7:58 am; high tide (+21.8 ft. MLLW) was at 3:21 am (Figure 39, blue line). The yellow line in Figure 39 represents the high tide (+22.3 ft. MLLW) line generated at 3:38 am on May 7, 2012. The red line in Figure 39 represents the approximate location of the extreme high tide (+24.8 ft. MLLW) line. No intertidal transect was necessary at this site because the area proposed for parking pad development is expected to be constructed above +23.4 ft. MLLW, which is the mean high tide line.

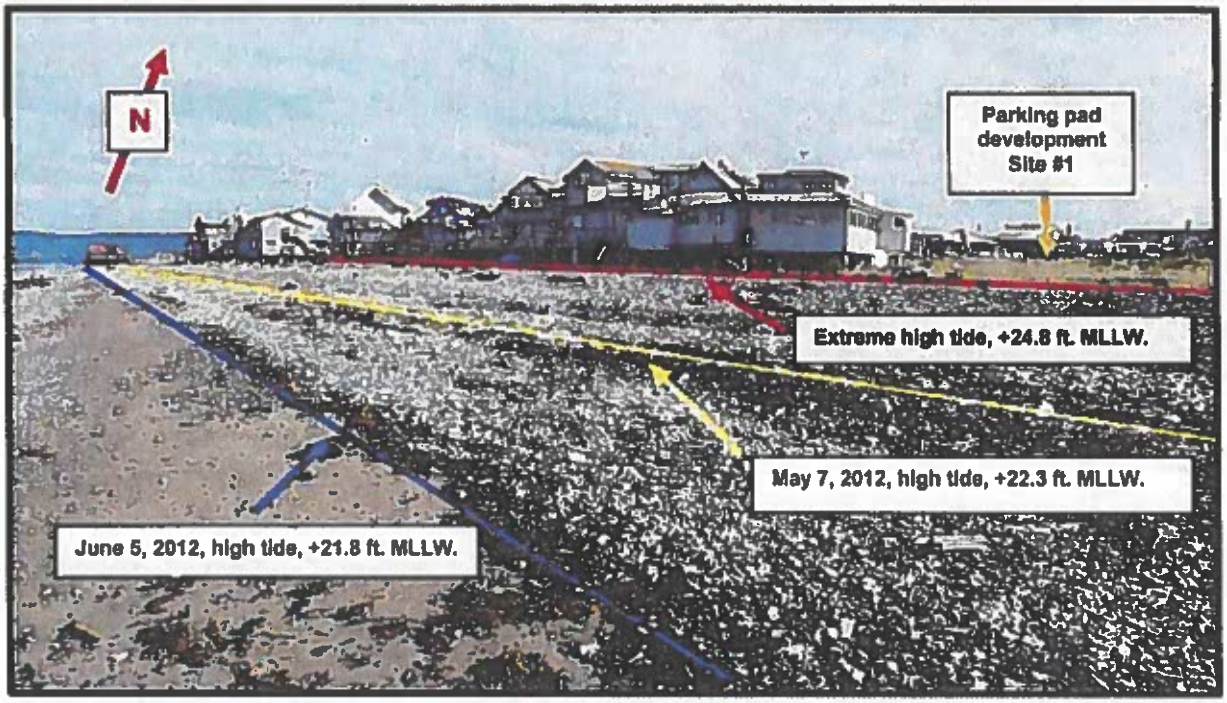


Figure 39. Parking pad development Site #1 on Homer Spit, Alaska in proximity to different tide levels.

The area proposed for parking pad development is in a depression between the Homer Spit Road and the beach berm created at the approximate location of the extreme high water line (+24 ft. MLLW) (Figure 40). Vegetation is predominantly sand/wild rye grass (*Elymus arenarius*) (Figure 41). Scattered within the rye grass are patches of leafy vegetation including: seabeach senecio (*Senecio pseudo-arnica*); beach pea (*Lathyrus maritimus*, also known as *Lathyrus japonicus maritimus*); Arnica (*Arnica chamissonis*); scurvy weed (*Honckenya peploides*); and seacoast angelica (*Angelica lucida*) (Figures 42 and 43). No wildlife was observed using the area during our site visit.

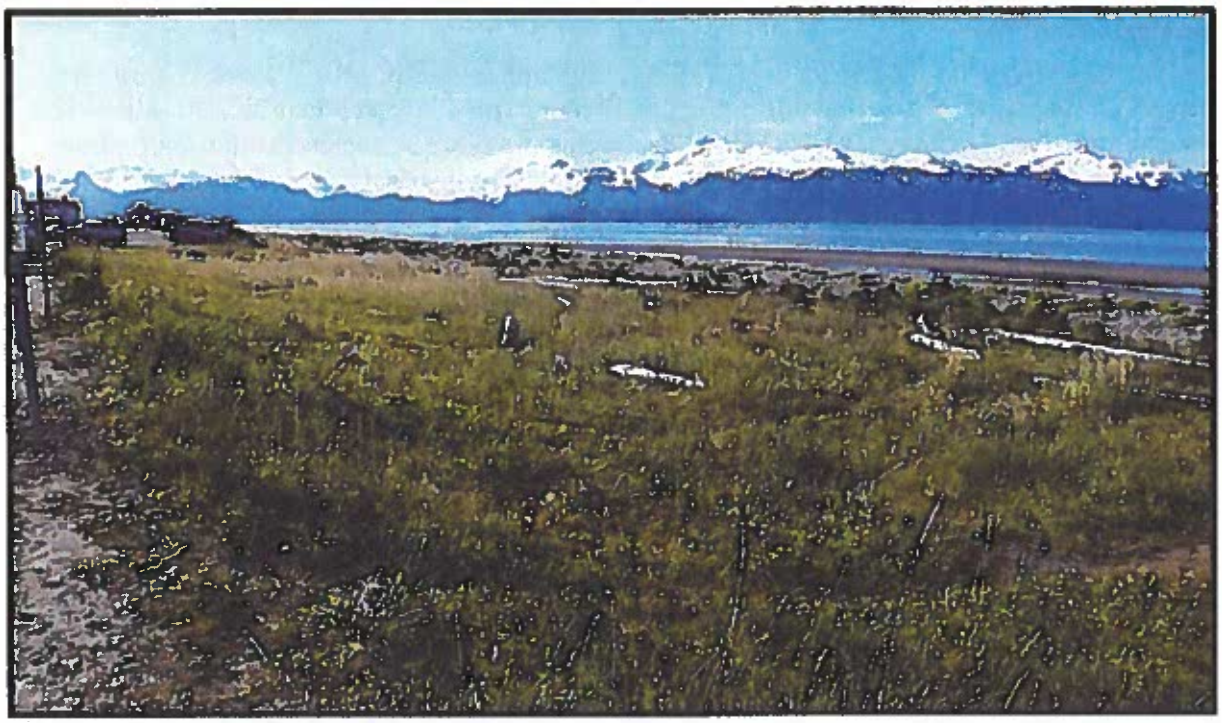


Figure 40. Parking pad development Site #1 on Homer Spit, AK. Note depression between road and beach berm.

Figure 41. Parking pad development Site #1on Homer Spit, AK. Note stand of sand/wild rye grass (*Elymus arenarius*)

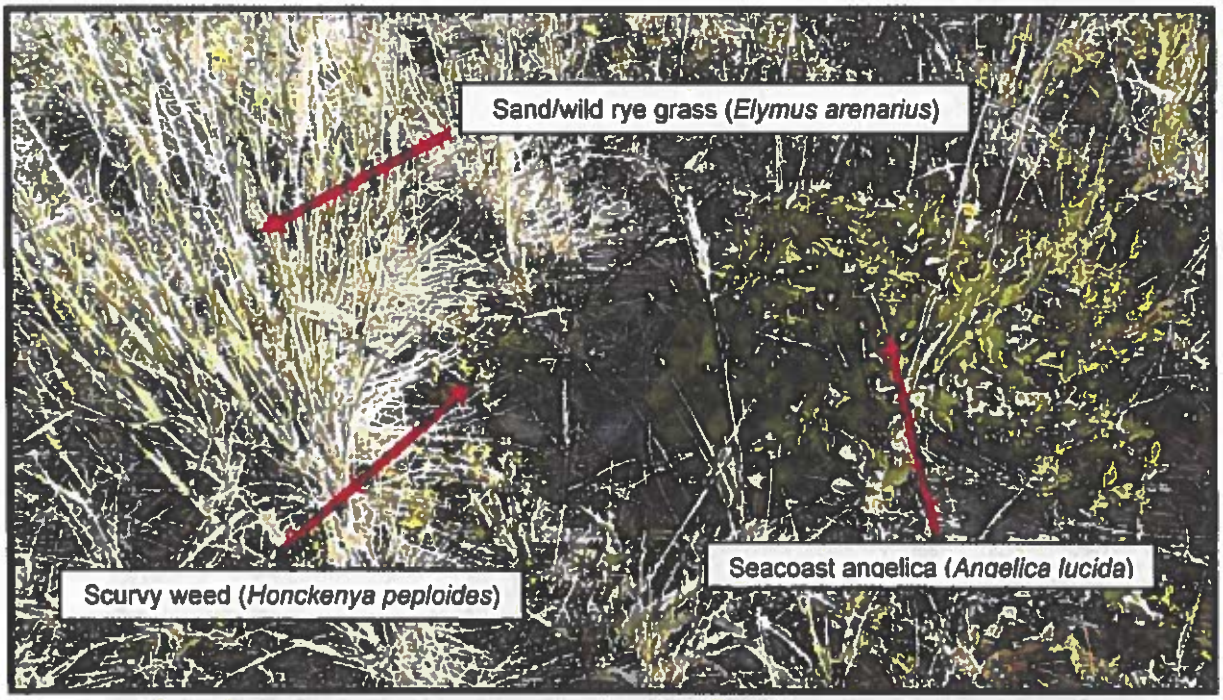


Figure 42. Parking pad development Site #1 on Homer Spit, AK. Ground cover vegetation.

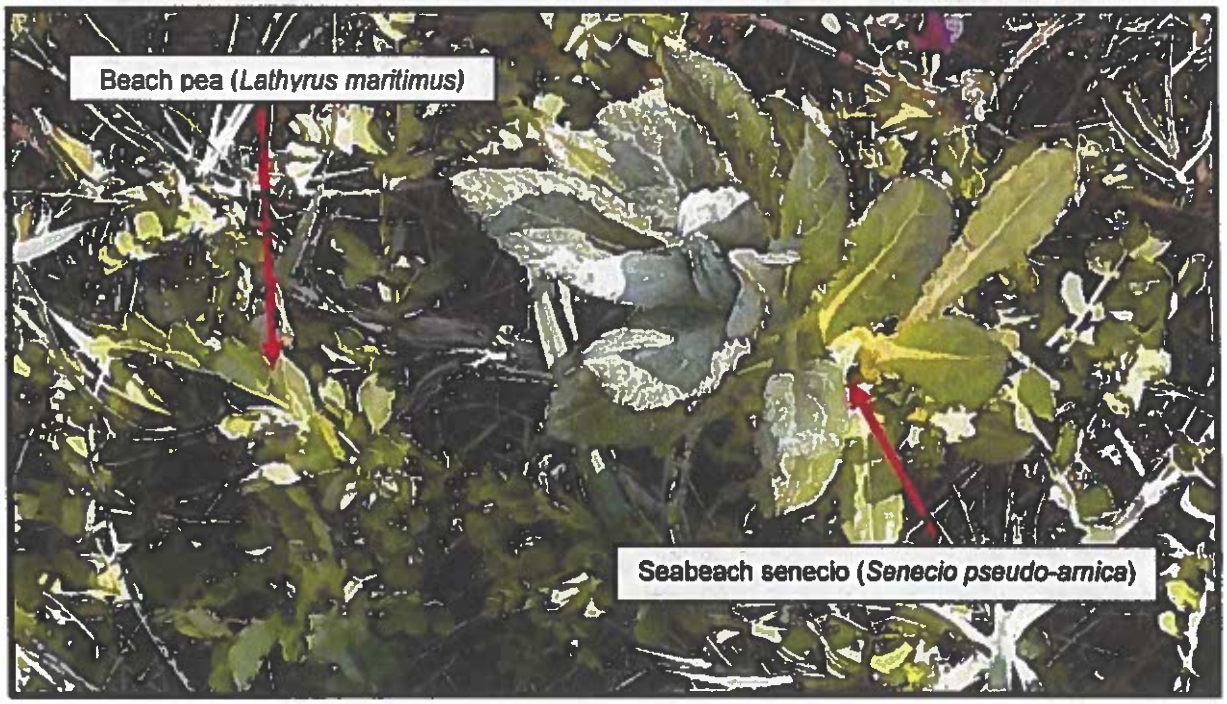


Figure 43. Parking pad development Site #1on Homer Spit, AK. Ground cover vegetation.

Parking Pad 2

Physical Surroundings and Features

This approximately 5.5 acre area extends approximately 900 feet between pile-supported commercial developments to the southeast and northwest and immediately adjacent to the Homer Spit Road (Figure 44). The parking pad's width would extend seaward approximately 90 feet from the edge of the Homer Spit Road. Except for the seaward shoreline of the area, the entire area is surrounded by harbor-related commercial developments and parking areas. The parking pad would be constructed using gravel fill. The existing area's substrate is primarily beach gravel covered with patches of a sandy vegetated mat.

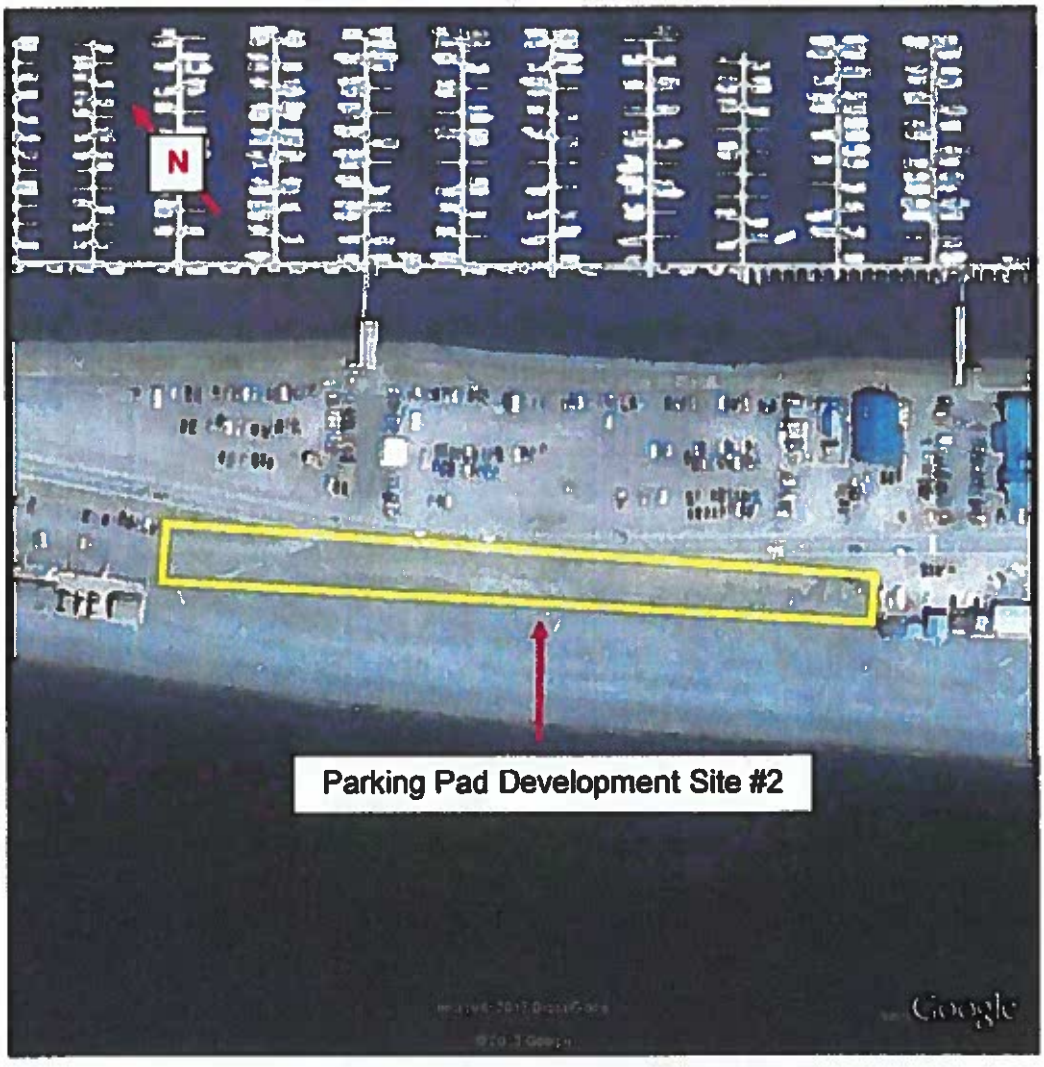


Figure 44. Parking pad development Site #2 on Homer Spit, Alaska.

Biological Features

This site was visited on June 7, 2012, at 9:40 am; high tide (+20.6 ft. MLLW) was at 4:59 am (Figure 45, orange line). The blue line in Figure 45 represents the high tide (+21.8 ft. MLLW) line generated at 3:21 am on June 5, 2012. The yellow line in Figure 45 represents the high tide (+22.3 ft. MLLW) line generated at 3:38 am on May 7, 2012. The red line in Figure 45 represents the approximate location of the extreme high tide (+24.8 ft. MLLW) line. No intertidal transect was necessary at this site because the area proposed for parking pad development is expected to be constructed above +23.4 ft. MLLW, which is the mean high tide line.

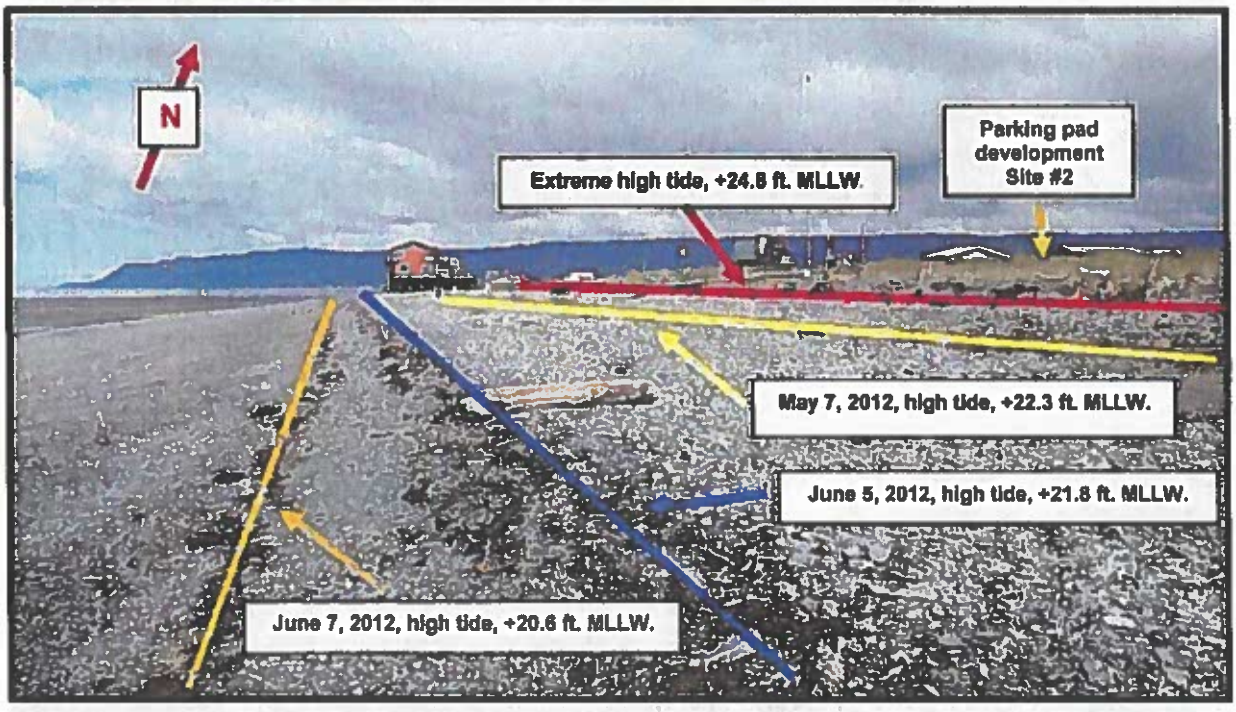


Figure 45. Parking pad development Site #2 on Homer Spit, Alaska in proximity to different tide levels.

The area proposed for parking pad development is in a depression between the Homer Spit Road and the beach berm created at the approximate location of the extreme high water line (+24.8 ft. MLLW) (Figure 46). Vegetation is predominantly sand/wild rye grass (*Elymus arenarius*) with patches of leafy vegetation including: sea sandwort (*Honckenya peploides*), seabeach senecio (*Senecio pseudo-arnica*); beach pea (*Lathyrus maritimus*, also known as *Lathyrus japonicus maritimus*); Arnica (*Arnica chamissonis*); scurvy weed (*Honckenya peploides*); sea bluebell (*Mertensia maritina*) and seacoast angelica (*Angelica lucida*) (Figures 47 and 48). No wildlife was observed using the area during our site visit.

Figure 46. Parking pad development Site #2 on Homer Spit, AK. Note depression between road and beach berm.

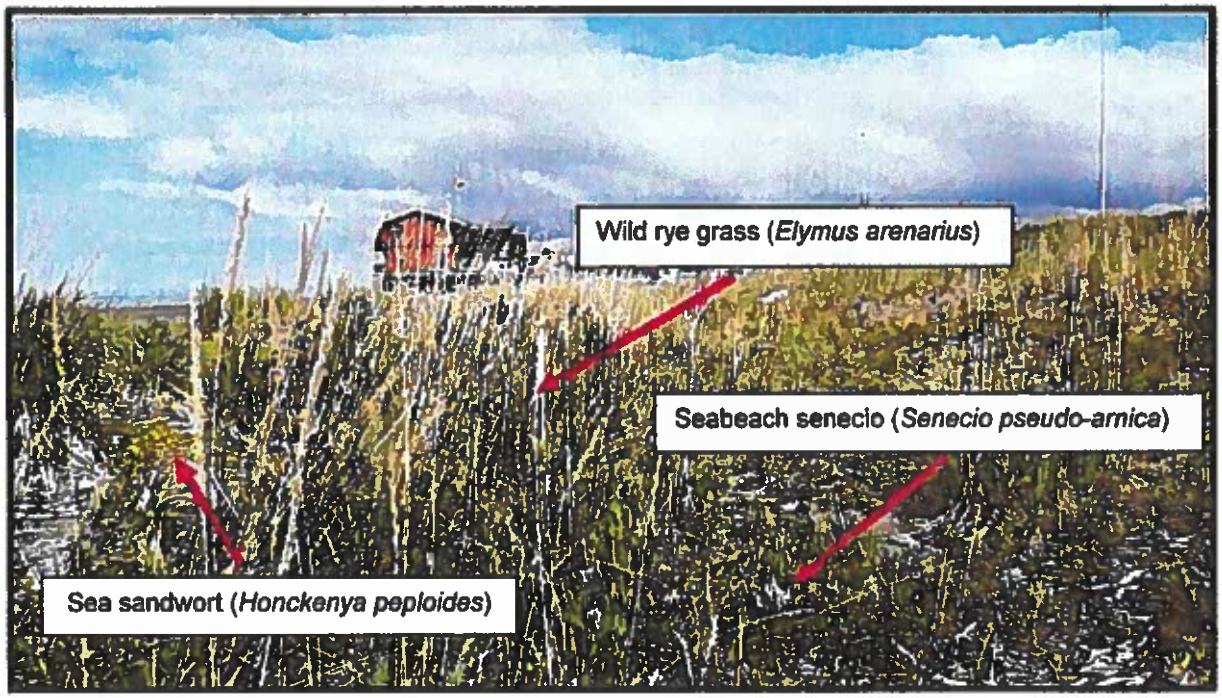


Figure 47. Vegetation within parking pad development Site #2 on Homer Spit, AK. Note patches of sand/wild rye grass (*Elymus arenarius*)

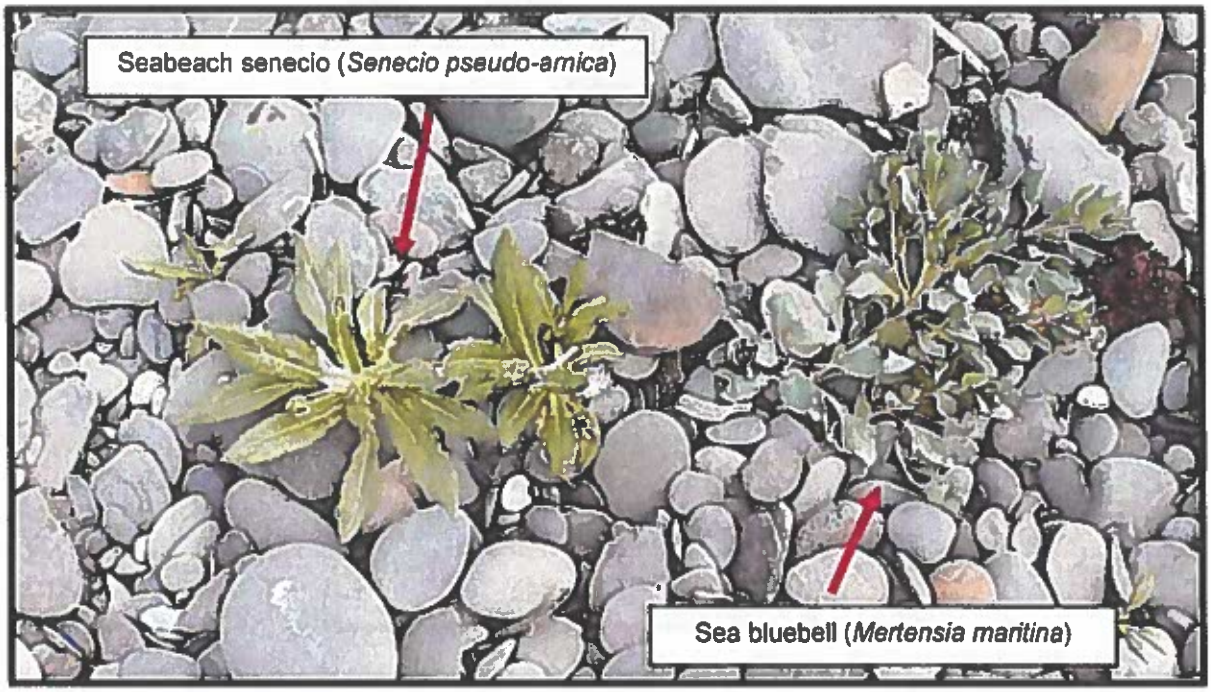


Figure 48. Vegetation within parking pad development Site #2 on Homer Spit, AK. Note washed-clean pebble substrate.

In-water Disposal Sites

Subtidal information at the two in-water disposal sites (Outside Homer Spit and Inside Homer Spit) was collected using boat-based sampling methods (Figure 49). A Ponar grab sampler (Figure 50) was used to collect bottom samples and a GPS was used to record their locations. Efforts to use a Remotely Operated Vehicle (Figure 51) to document substrate type and benthic communities proved unsuccessful because of too-swift currents at depth and high vessel traffic.

Figure 49. In-water disposal sites were investigated using boat-based sampling methods (ROV, bottom samples).

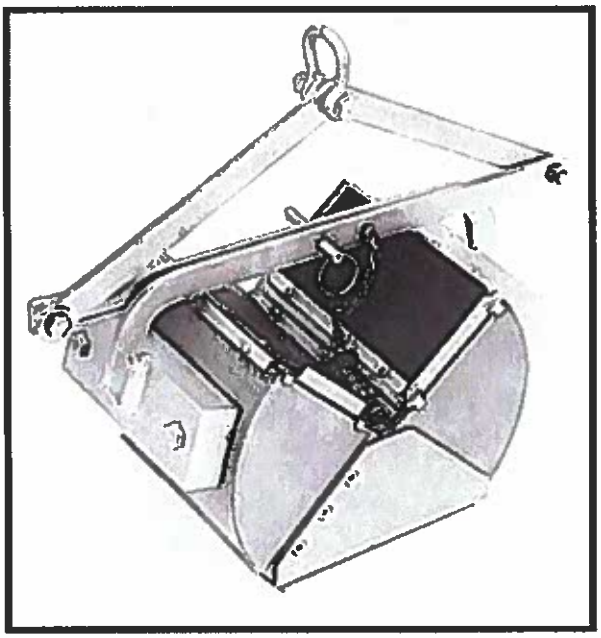


Figure 50. Ponar grab sampler used to collect bottom sediments from proposed in-water dredged material disposal sites, Homer Spit, AK.

Figure 51. Same type of ROV used to conduct April 2013 subtidal investigations at Sitka, AK. was used for the same type of investigations at potential in-water disposal sites of material dredged from the Homer Small Boat Harbor and face of the U.S. Coast Guard dock, Homer Spit, AK.

Outside Homer Spit

Physical Surroundings and Biological Features

The relative size of this in-water disposal area is approximately 3 acres and located 800 feet from the southern tip of the Homer Spit (Figure 52).

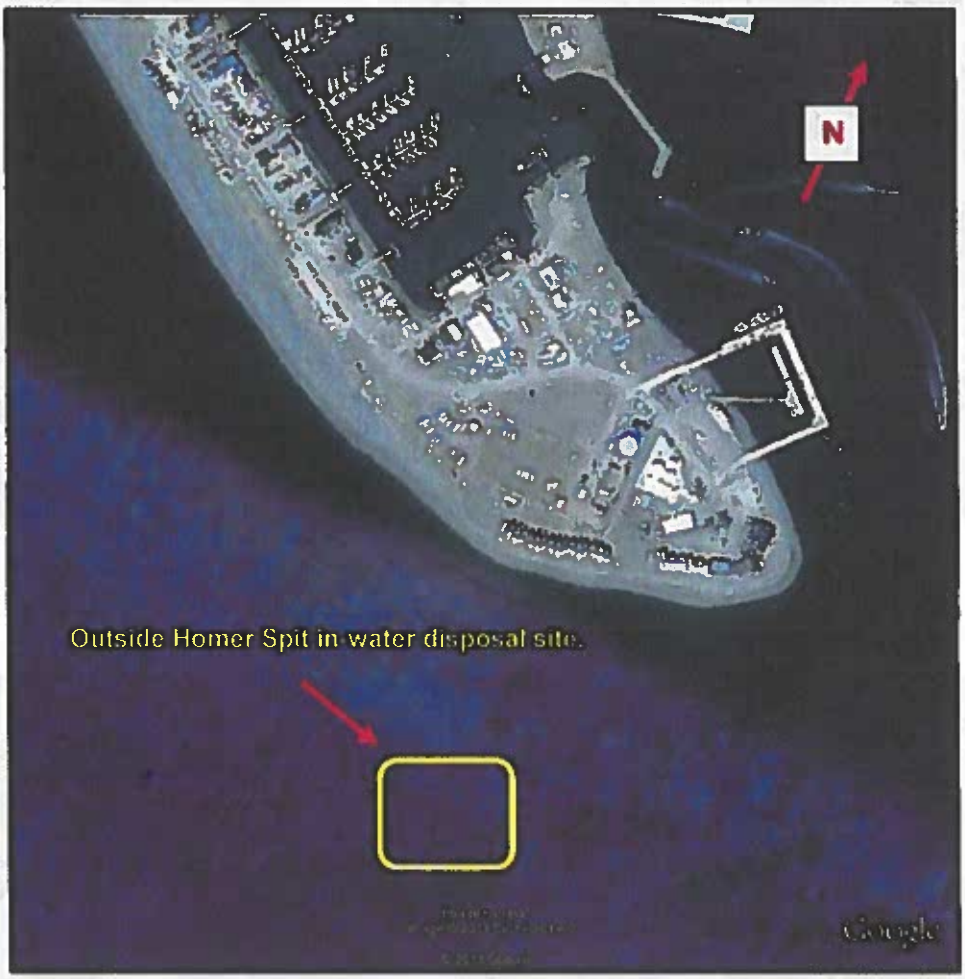


Figure 52. Relative location of the Outside Homer Spit in-water dredged material disposal area, Homer Spit, AK.

More specifically, the disposal area lies just off Archimandritof Shoals in water depths ranging between 60 to 130 feet (Figure 53). Attempts to video tape the disposal site's benthic habitat were thwarted by swift currents. Attempts to obtain substrate samples using a clamshell bottom sampler proved equally difficult because of swift currents and the compact/dense nature of the substrate to be sampled. Two clamshell grabs came up empty, but a third attempt proved successful. One bottom sample was collected on June 5, 2012, within the disposal site at 59°35'47.3" N, 151°24'56.3" W at a depth of 124.4 feet (Figure 53). The bottom sample was composed of very fine sand and small coal fragments and void of epi-and infauna (Figure 54).

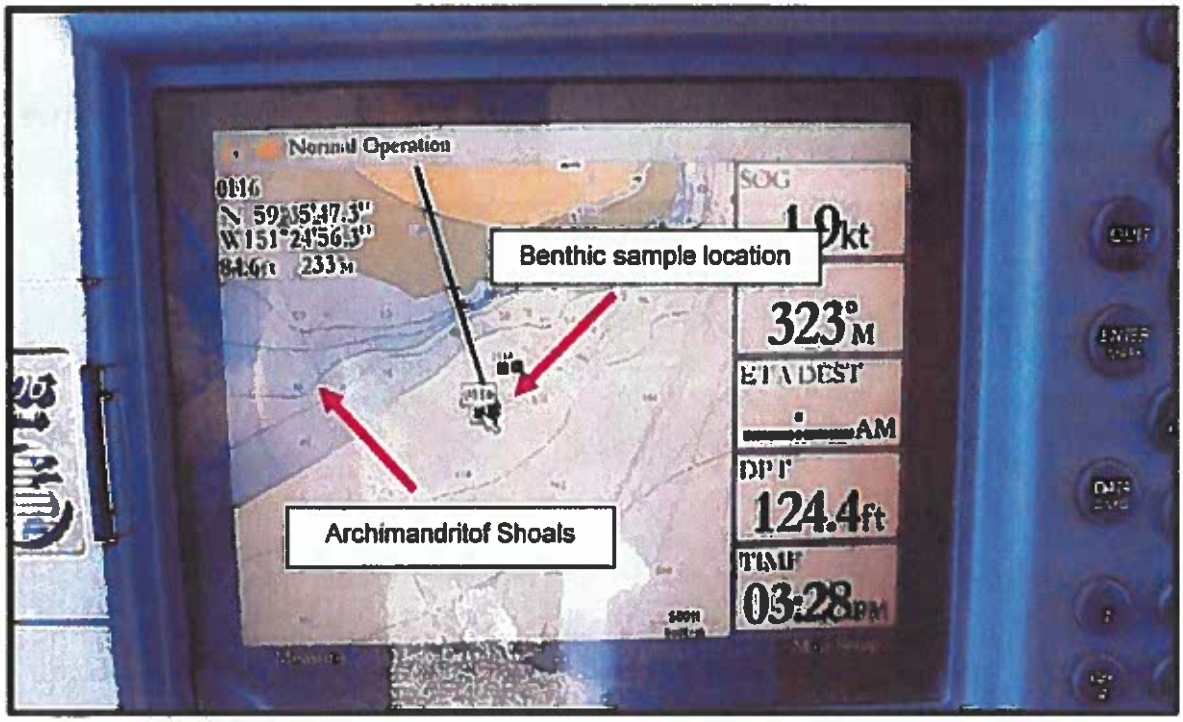


Figure 53. On board navigation system display of Archimandritof Shoals and Outside Homer Spit benthic sample locations.

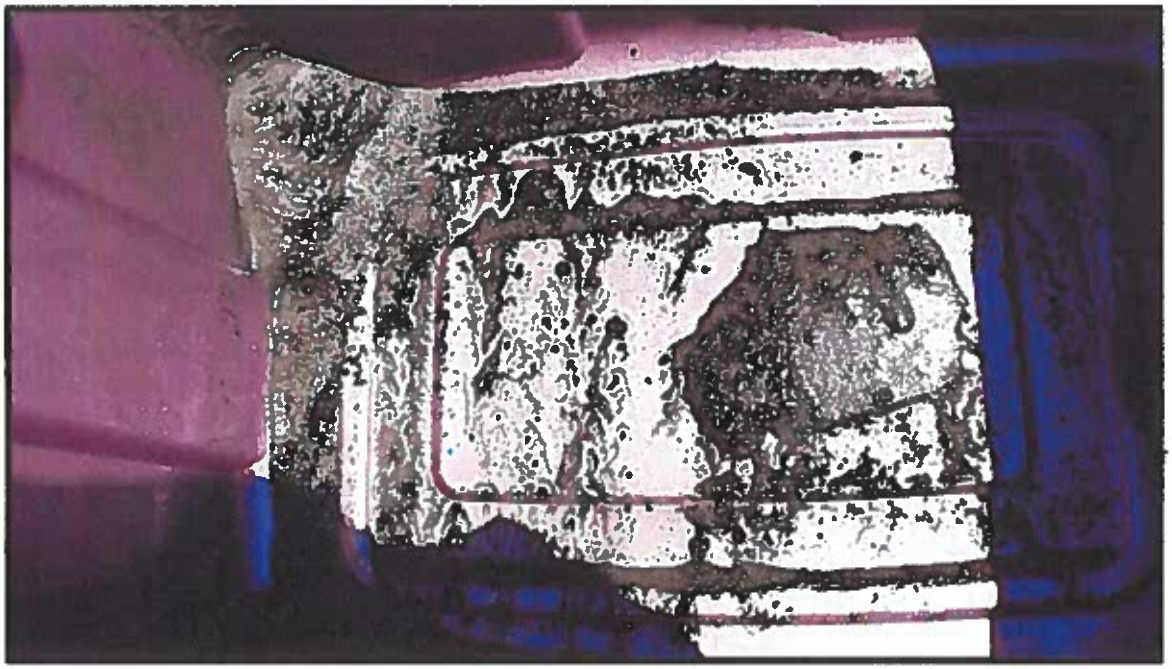


Figure 54. Bottom sample collected at the Outside Homer Spit in-water disposal area, Homer Spit, AK. Note fragments of coal within the substrate sample.

Inner Kachemak Bay Site

Physical Surroundings and Biological Features

The relative size of this in-water disposal area is the same as the Outer Kachemak Bay in-water disposal area, i.e., approximately 3 acres, and located just outside of the Homer Small Boat Harbor entrance channel (Figure 55).

Figure 55. Relative location of the Inner Kachemak Bay in-water dredged material disposal area, Homer Spit, AK.

More specifically, the disposal area lies in water depths ranging between 60 to 180 feet (Figure 56). Attempts to video tape the disposal site's benthic habitat were thwarted by swift currents and vessels transiting in and out of the harbor. Bottom sampling proved more successful here because the substrate was softer and therefore easier to penetrate. Samples were collected on June 5, 2012, at 59°36'14.7" N, 151°24'40.3" W at a depth of 84 feet (Figure 56). The bottom sample was composed of muddy sediment; no epifauna was collected and the only infauna seen in the sediment were polychaete worms and/or their casings (Figure 57).

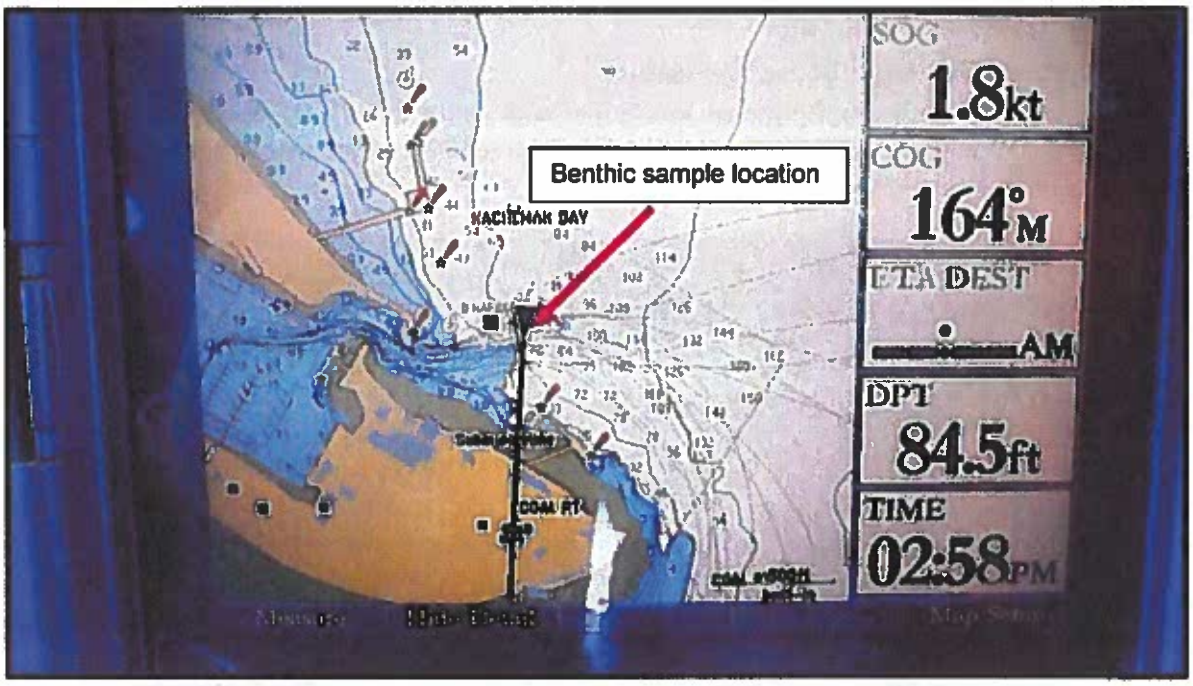


Figure 56. On board navigation system display of the Inner Kachemak Bay benthic sample locations.

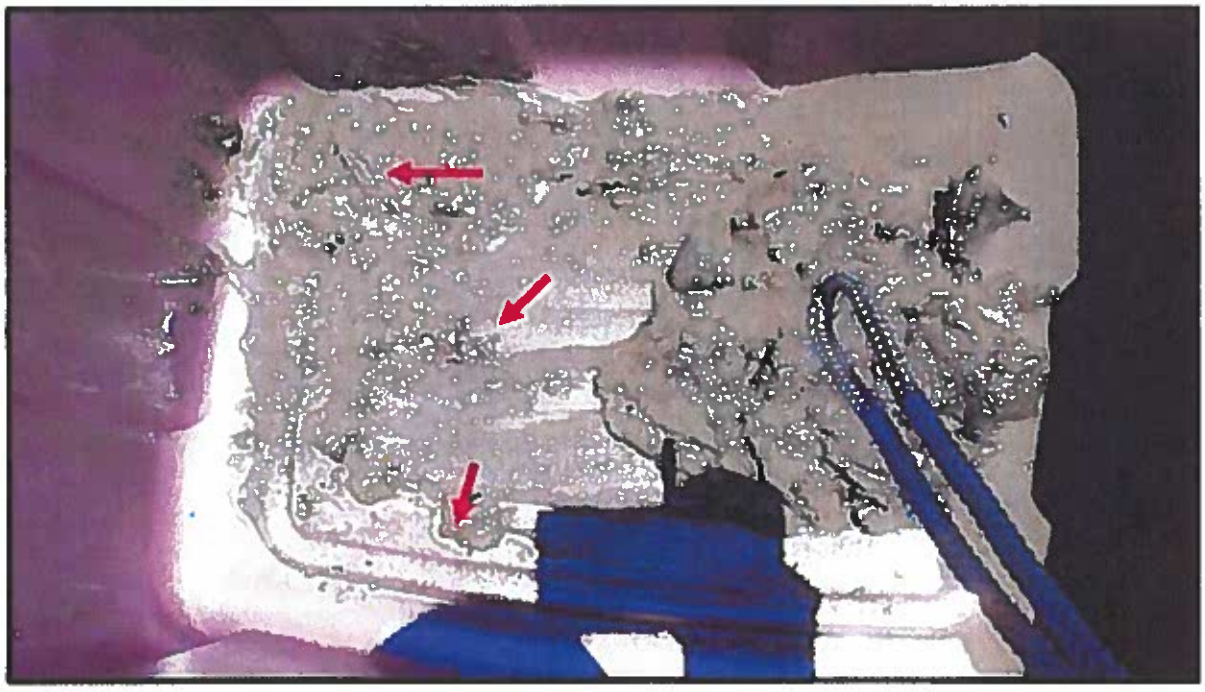


Figure 57. Bottom sample collected at the Inner Kachemak Bay in-water disposal area, Homer Spit, AK. Note: red arrows indicate the presence of polychaete worms and/or casing.

New Harbor Staging Area

Location

The coordinates of the new harbor staging area are 59°36'24.19" N, 151°25'01.84" W.

Physical Surroundings and Features

This nine acre disposal site is associated with the City of Homer's desire to construct an additional small boat harbor, boat ramp and staging area on the Homer Spit (Figure 58). Over time, material dredged from the existing small boat harbor and from the construction of the new harbor would be placed within a confined disposal area and once filled to capacity the area would subsequently be used as the new harbor's staging area.

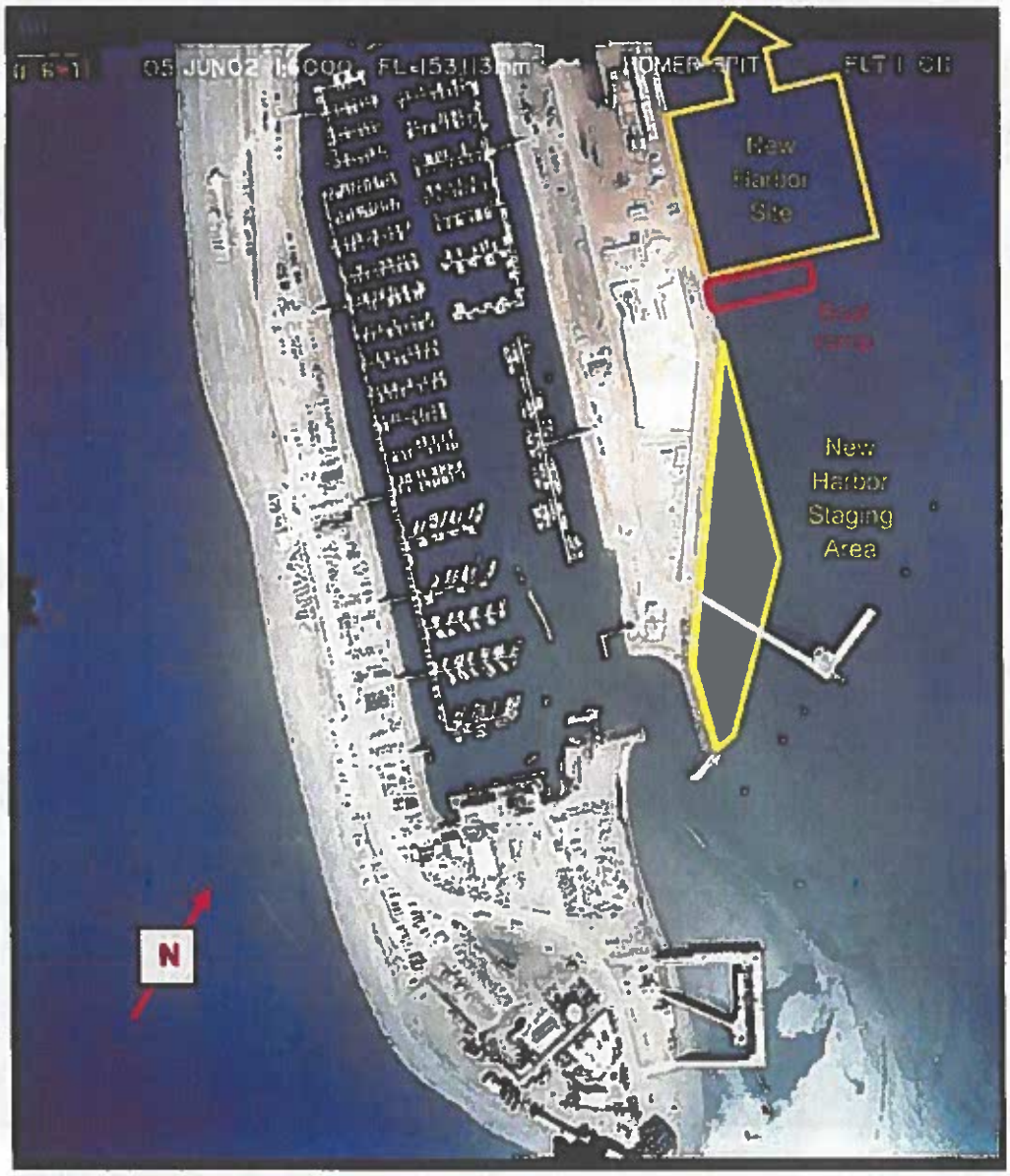


Figure 58. Conceptual location of a potential new boat harbor's staging area, Homer Spit, AK.

The existing shoreline is lined with armor stone riprap (Figure 59) for storm protection and the adjacent upland was created with fill material from a previous harbor expansion project. The adjacent land use is designated in the Homer Spit Comprehensive Plan as industrial and associated with the deepwater dock which extends offshore from the area (Figure 60).

Figure 59. Armor stone riprap protecting the shoreline at the New Harbor Staging Area disposal site, Homer Spit, AK.

Figure 60. Deep water dock extending through the New Harbor Staging Area disposal site, Homer Spit, AK.

Biological Features

After conducting a reconnaissance survey of the area, three intertidal transects (NHSA 1, NHSA 2, and NHSA 3) were positioned so that the maximize amount of biological information could be collected from an intertidal area lush with marine algae and a variety of benthic habitat (Figure 61 and 62). However, none of the three transects were able to extend the full 300 feet because of water depths too deep to survey from land.

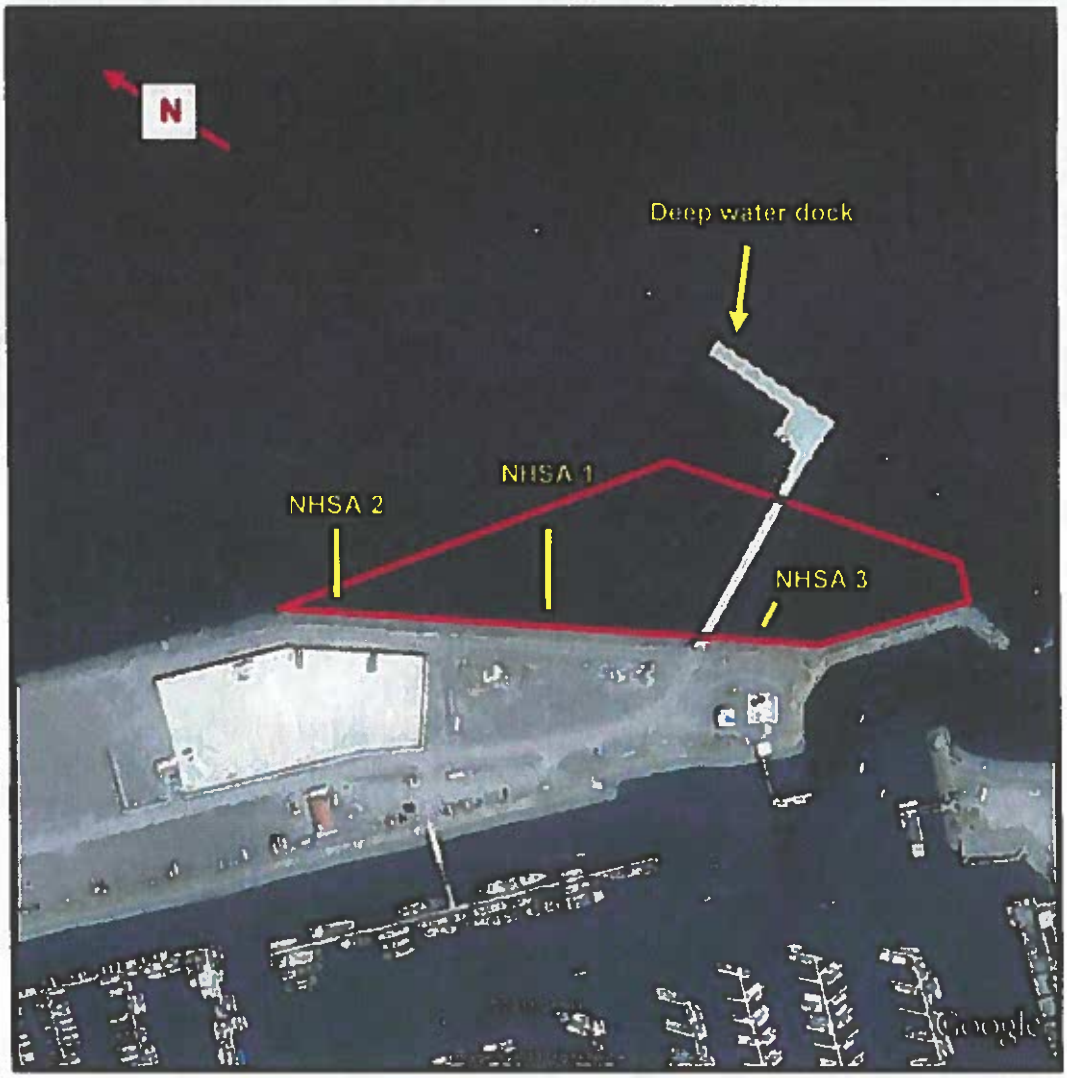


Figure 61. Approximate locations of intertidal transects at New Harbor Staging Area disposal site (red outline), Homer Spit, AK.

Figure 62. An overview of intertidal habitat exposed at low tide within Transect NHSA 1 (yellow line) Note elevated patches of boulder/cobble benthic habitat (red arrows).

Transect NHSA 1

Location: 59°36'22.33" N, 151°25'07.85" W
Time: 9:31 am, June 5, 2012
Tide stage: Low tide at 9:54 am, -5.54 feet MLLW
Observations along transect which began at water's edge (Figures 62 and 63).

- 0 to 70 ft. – scattered patches of rock with attached kelp cover on sandy substrate. Scattered starfish amongst patches of kelp. Sandy substrate with polychaetes (Figure 64).
- 72 to 97 ft. – a raised bench of boulders (Figures 62, 63 and 65) and cobble with less kelp cover but having the same epi/infauna as aforementioned described.
- 97 to 160 ft. – Beginning at water's edge, habitat consisted of boulders/cobble heavily covered with *Laminaria* sp., ribbon kelp, and the green algae *Ulva* sp.. Beneath the kelp cover the rocky substrate was encrusted with worm casing and bryophytes, as well as having red algae (albeit not identified) attached. Crevices between the rock were inhabited with a variety of sea stars and crustaceans, sea urchins, limpets, snails and other infauna (Figures 66 and 67).

Figure 63. Transect NHSA 1, Homer Spit, AK. Note elevated boulder/cobble benthic habitat, circled in red. See Figure 65 also.

Figure 64. Transect NHSA 1, Homer Spit, AK. Habitat between 0 to72 feet.

Figure 65. Transect NHSA 1, Homer Spit, AK. Habitat between 72 to 97 feet.

Figure 66. Transect NHSA 1, Homer Spit, AK. Habitat between 97 to 160 feet.

Figure 67. Transect NHSA 1, Homer Spit, AK. Habitat between 97 to 160 feet.

Transect NHSA 2

Location: 59°36'18.45" N, 151°25'00.90" W
Time: 10:04 am, June 5, 2012
Tide stage: Low tide at 9:54 am, -5.54 feet MLLW
Observations along transect (Figures 68 and 69):

- Special note: The entire transect's contour was very flat with an occasional boulder providing some topographic relief. Water was very slow to drain away at low tide.
- 0 to 54 ft. – hard packed sandy substrate continues without the density of algal cover. Substrate nearest the toe of the rip rap is more gravelly with a collection of shell fragments and algal debris.
- 54 to 72 ft. – Beginning at water's edge. Small scattered cobble on hard packed sandy substrate. Kelp attached to cobble; fragments of *Ulva* sp.. Numerous sea stars scattered about. (Figures 69 and 70).
- 72 to 76 ft. – water at a depth of approximately one foot. Covering the entire sandy/muddy substrate were ribbon kelp and *Laminaria* sp. attached to individual pieces of gravel. Mixed among the kelp fronds were small crustaceans, sea stars (*Pisaster* sp., *Evasterias* sp.) and polychaete worms.
- Note: Photos 71 and 72 illustrate the large collection of sea stars at low tide and scattered patches of eel grass in proximity to transect, near the toe of rip rap.

Figure 64. Transect NHSA 2, Homer Spit, AK.

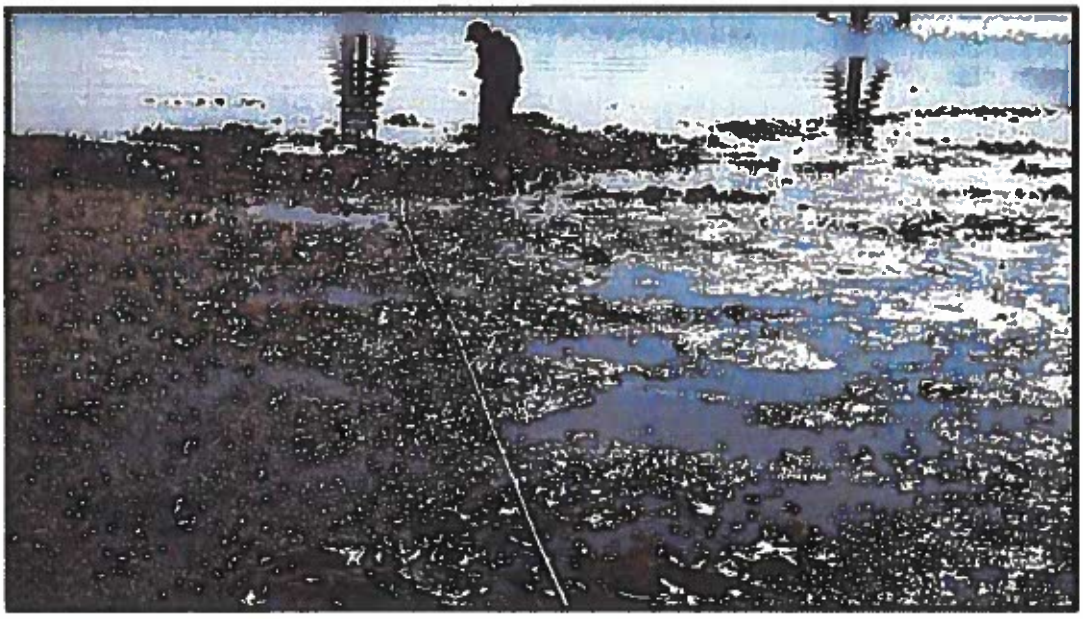


Figure 65. Transect NHSA 2, Homer Spit, AK.

Figure 66. Transect NHSA 2, Homer Spit, AK.

Figure 67. Large collection of sea stars exposed at low tide in proximity to Transect NHSA 2, Homer Spit, AK.

Figure 68. Scattered patches of eel grass exposed at low tide in proximity to Transect NHSA 2, Homer Spit, AK.

Transect NHSA 3

Location: 59°36'26.09" N, 151°25'14.20" W
Time: 10:26 am, June 5, 2012
Tide stage: Low tide at 9:54 am, -5.54 feet MLLW
Observations along transect (Figures 73 and 74):

- 0 to 18 ft. – this area is the splash zone on the rip rap revetment. Scattered barnicles, algal fragments, *Fucus* sp., mussels and snails.
- 18 to 31 ft. – area at the toe of rip rap has larger cobble and boulders covered with kelp. Scattered within the kelp is an assortment of crustaceans and some sea stars.
- 31 to 121 ft. – the habitat noted above begins to thin out and the substrate is mostly hard packed sand. Seas star population has decreased, as less kelp canopy is present.
- 121 to 156 ft. – transect began within the water. Gravel substrate on hard packed sand. Scattered boulders and cobble heavily covered with *Laminaria* sp.and ribbon kelp. Some *Ulva* sp. under the kelp canopy. Numerous crustaceans, echinoderms, mollusks and shell fragments. Water edge at 136 ft.

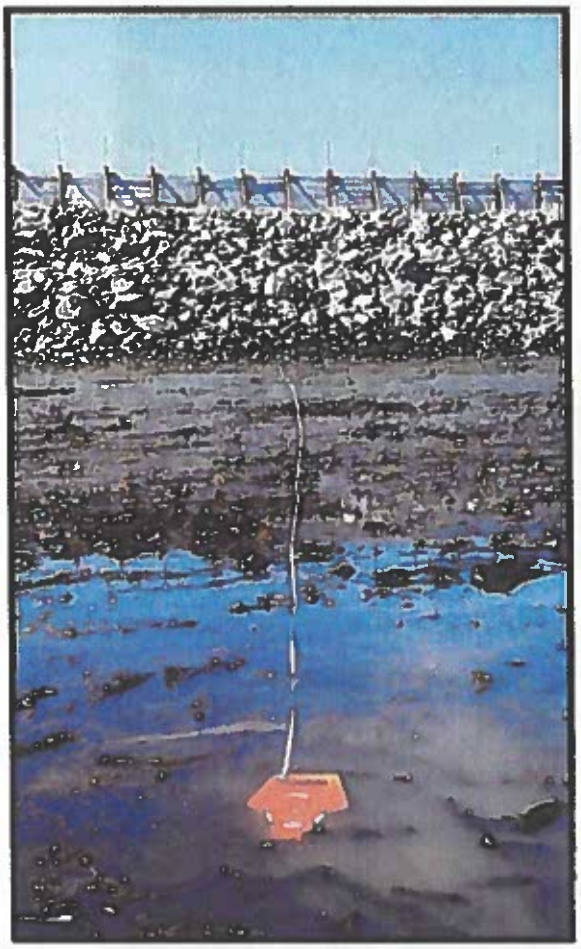


Figure 69. Lower reaches of Transect NHSA 3.

Figure 70. Upper reaches of Transect NHSA 3.

- Miscellaneous observations (Figures 75 and 76): The entire intertidal area northeast of the deep water dock, and adjacent to the rip rap protecting the eastern shore of the Homer Spit, is heavily vegetated with kelp and other brown and green algae which support a diverse assemblage of marine organisms. The area is very flat and at the lowest of tides, the entire area is left exposed. Scattered patches of boulders and cobble, however, provide some topographic relief. Based on field observations alone, this area likely provides the most diverse and species rich (albeit undefined) marine habitat on the Homer Spit.

Figure 71. Intertidal area east of Transect NHSA 3, Homer Spit, AK.

Figure 72. Intertidal area east of the deep water dock, Homer Spit, AK.

Appendix B

City of Homer Tideland Ownership and Ordinances Regarding the Use and Disposal of Material Dredged from Homer Spit and the Port of Homer

BOOK 80 PAGE 171
Homer Recording District

State of Alaska

Patent

Tidelands No. 271

Know All Men By These Presents that the State of Alaska, pursuant to A.S. 38.05.320, as amended and the rules and regulations promulgated thereunder, and in consideration of:

A Municipal Preference Right

and other good and valuable consideration, does hereby grant to:

City of Homer

Box 335

Homer, Alaska

their heirs and assigns, those Tidelands lying seaward of the mean high tide line in Kachemak Bay, State of Alaska, described as follows:

Commencing for reference at the northwest corner of Section 23, Township 6 South, Range 14 West, Seward Meridian, said point being on the westerly boundary of the incorporated limits of the City of Homer, Alaska and located approximately at Latitude 59°39' North, Longitude 151°37'40" West; thence S0°07'05"W 556.36 feet along the westerly boundary of said Section 23 to the original 1918 general land office meander line of mean high water and the Point of Beginning; thence S64°07'07"E 2240.51 feet; thence S61°52'20"E 452.70 feet; thence N78°09'09"E 567.73 feet; thence S84°20'25"E 330.06 feet; thence S67°51'57"E 699.57 feet; thence S66°22'04"E 374.84 feet; thence S80°20'31"E 336.66 feet; thence S88°20'12"E 660.13 feet; thence S88°22'09"E 1311.44 feet; thence S71°23'39"E 1935.46 feet; thence S69°08'40"E 660.54 feet; thence S71°53'37"E 663.22 feet; thence S79°37'58"E 905.74 feet; thence S77°25'02"E 257.50 feet; thence S81°25'25"E 1657.35 feet; thence S82°55'10"E 1320.63 feet; thence S87°54'21"E 950.89 feet; thence S68°27'16"E 1003.34 feet; thence S69°59'56"E 506.22 feet; thence S58°16'28"E 1097.18 feet; thence S44°41'07"E 417.64 feet; thence S51°02'28"E 1089.00 feet; thence S72°28'37"E 308.94 feet; thence N89°18'56"E 1183.24 feet; thence N74°17'25"E 941.70 feet; thence S89°06'09"E 352.60 feet; thence S78°42'47"E 611.84 feet; thence S68°10'39"E 776.15 feet; thence S68°11'03"E 673.88 feet; thence S77°56'02"E 710.24 feet; thence S77°56'10"E 152.34 feet; thence S66°26'16"E 557.18 feet; thence S66°26'23"E 720.51 feet; thence S66°02'19"E 310.45 feet; thence S66°37'57"E 50.06 feet; thence S66°25'14"E 443.23 feet; thence S61°32'58"E 663.96 feet; thence S60°30'42"E 300.78 feet; thence S60°28'01"E 1218.97 feet; thence S60°25'45"E 287.16 feet; thence S56°25'34"E 1776.37 feet; thence S50°19'25"E 1446.42 feet; thence S44°49'22"E 1592.13 feet; thence S42°03'02"E 1652.72 feet; thence S45°33'02"E 1835.49 feet; thence S47°42'02"E 761.64 feet; thence S46°36'00"E 430.62 feet; thence S49°50'34"E 17.56 feet; thence S49°52'43"E 238.13 feet; thence S49°49'16"E 627.74 feet; thence S49°49'54"E 393.56 feet; thence S45°18'45"E 506.81 feet; thence S45°03'43"E 114.74 feet; thence S51°19'07"E 359.11 feet; thence S51°36'52"E 381.95 feet; thence S58°01'15"E 777.55 feet; thence S58°00'10"E 779.24 feet; thence N00°06'00"W 41.45 feet; thence S57°05'50"E 317.08 feet; thence S64°05'43"E 1280.48 feet; thence S89°20'02"E 244.24 feet; thence N72°09'48"E 455.48 feet; thence N77°54'52"E 283.85 feet; thence N46°54'40"E 158.44 feet; thence N02°49'55"W 165.06 feet; thence N35°19'09"W 303.66 feet; thence N51°19'06"W 257.41 feet; thence N57°34'11"W 409.20 feet; thence

N60°19'13"W 765.58 feet; thence N55°34'09"W 726.01 feet; thence N77°34'38"W 250.77 feet; thence S12°05'23"E 112.16 feet; thence S71°05'34"E 264.03 feet; thence S57°40'21"W 164.96 feet; thence N50°34'07"W 500.12 feet; thence N00°06'00"W 82.37 feet; thence N36°46'33"W 180.79 feet; thence N53°06'06"W 357.48 feet; thence N52°19'23"W 337.35 feet; thence N52°16'02"W 394.87 feet; thence N61°46'36"W 394.14 feet; thence N61°50'09"W 1.32 feet; thence N59°49'10"W 1059.27 feet; thence N55°49'20"W 547.78 feet; thence N75°35'25"W 369.66 feet; thence N07°35'13"W 224.99 feet; thence N33°34'47"W 309.49 feet; thence N36°19'48"W 837.43 feet; thence N41°19'50"W 1914.49 feet; thence N38°16'17"W 1417.71 feet; thence N40°17'03"W 446.01 feet; thence N35°52'05"W 742.95 feet; thence N41°48'50"W 1343.65 feet; thence N69°33'34"W 335.98 feet; thence N41°48'51"W 751.68 feet; thence N58°03'06"W 408.56 feet; thence N70°16'54"W 345.89 feet; thence S85°00'00"W 469.92 feet; thence N46°12'10"W 1692.19 feet; thence N54°27'10"W 281.16 feet; thence N68°42'08"W 162.36 feet; thence S47°11'50"E 2128.56 feet; thence S82°02'58"W 332.64 feet; thence N77°57'04"W 757.62 feet; thence N77°56'19"W 1129.72 feet; thence N66°06'45"W 237.89 feet; thence N66°06'45"W 543.91 feet; thence N51°55'22"W 452.80 feet; thence N41°10'20"W 573.70 feet; thence N25°25'42"W 365.83 feet; thence N34°40'25"W 245.61 feet; thence N60°10'33"W 277.85 feet; thence S33°28'36"E 911.12 feet; thence S43°18'44"W 266.50 feet; thence N85°11'44"W 404.57 feet; thence N68°40'52"W 1183.86 feet; thence N73°26'05"W 1844.01 feet; thence N00°03'00"E 332.87 feet; thence N46°14'39"E 104.60 feet; thence N61°45'09"E 698.17 feet; thence N80°46'46"E 2484.72 feet; thence N80°39'14"E 1573.37 feet; thence S67°47'14"E 486.30 feet; thence S59°01'52"W 283.05 feet; thence S66°46'18"E 125.37 feet; thence N61°52'53"E 1134.20 feet; thence N61°51'40"E 742.78 feet; thence N57°41'48"E 503.86 feet; thence N45°30'00"E 335.28 feet; thence N45°56'47"E 542.85 feet; thence S70°14'08"E 143.97 feet; thence N73°28'14"E 827.41 feet; thence N71°04'00"E 12.02 feet; thence N73°21'10"E 181.54 feet; thence N66°22'53"E 556.91 feet; thence N56°36'05"E 748.21 feet; thence N50°42'53"E 2729.09 feet; thence N35°55'32"E 200.79 feet; thence N22°25'19"E 609.15 feet; thence 201.79 feet; thence N31°39'30"E 803.59 feet; thence N01°27'48"E 1620.07 feet; thence N08°26'58"E 579.60 feet; thence N09°11'47"E 1053.58 feet; thence N14°32'08"E 608.07 feet to the northerly boundary of Section 14, Township 6 South, Range 13 West, Seward Meridian, and the northerly boundary of the incorporated limits of the City of Homer, Alaska; thence S61°28'05"E 6354.70 feet along the northerly side boundary of A.T.S. 612, seaward into Kachemak Bay; thence S27°37'30"W 8442.67 feet along the Director's line; thence South 5300.00 feet along the Director's line; thence S24°12'46"E 6243.27 feet along the Director's line; thence S57°59'44"E 1500.00 feet along the Director's line; thence S25°37'09"W 158.77 feet to the most northerly corner of the U. S. Corps of Engineers harbor line; thence S47°20'49"E 483.33 feet along the seaward boundary of said harbor line; thence S23°01'41"E 474.35 feet along the seaward boundary of said harbor line; thence S57°24'26"W 144.80 feet along the seaward boundary of said harbor line; thence S35°58'27"W 818.47 feet along the seaward boundary of said harbor line and the most southerly corner thereof; thence west 3450.00 feet along the Director's line; thence N64°00'00"W 21150.00 feet along the Director's line; thence N76°41'10"W 19788.01 feet along the Director's line; thence N19°59'54"E 4397.27 feet along the westerly side boundary of A.T.S. 612 to the Point of Beginning. Excluding therefrom parcels 1 and 2 as follows:

BK 80 PAGE 175
Homer Recording District

EXCLUSION NO. 1 TO ATS 612

Commencing for reference at R.M. No. 49, ATS 612.

Thence S12°23'41"W 100.63 feet to the most westerly corner of ADL 19360 and the Point of Beginning of Exclusion No. 1; thence N46°54'40"E 158.44 feet; thence N02°49'55"W 163.06 feet; thence N19°19'09"W 62.03 feet; thence N89°55'00"E 100.00 feet; thence S00°04'00"E 229.57 feet; thence S46°31'50"W 181.79 feet; thence N43°28'10"W 49.41 feet to the Point of Beginning. Containing an area of 0.530 acres more or less.

EXCLUSION NO. 2 TO ATS 612

Commencing for reference at R.M. No. 49, ATS 612.

Thence S12°23'41"W 100.63 feet to the most northerly corner of ADL 19361 and the Point of Beginning of Exclusion No. 2; thence S43°28'10"E 49.91 feet; thence S46°31'50"W 271.16 feet; thence S71°25'00"W 100.00 feet; thence N18°35'00"W 167.06 feet; thence S72°09'48"W 247.85 feet; thence N17°50'12"W 25.00 feet; thence N72°09'48"E 290.48 feet; thence N77°54'52"E 283.85 feet to the Point of Beginning. Containing an area of 1.211 acres more or less.

Known as ATS 612 and containing a net area of 6831.071 acres located in protracted portions of T6 and 7S, R13W and T6S, R14W, Seward Meridian

Section -- , Township -- , Range -- , -- Meridian

according to the official plat of survey thereof, on file and of record with the Division of Lands and recorded in Filing No: 74-2449 Book -- Page -- of the official records of the Homer Recording Precinct, Homer, Alaska

The Grantor, Alaska, expressly reserves, out of the grant hereby made, unto itself, its lessees, successors, and assigns forever, all oils, gases, coal, ores, minerals, fissionable materials, and fossils of every name, kind or description, and which may be in or upon said lands above described, or any part thereof, and the right to explore the same for such oils, gases, coal, ores, minerals, fissionable materials and fossils of every name, kind or description, and which may be in or upon said lands above described, or any part thereof, and the right to explore the same for such oils, gases, coal, ores, minerals, fissionable materials and fossils, and it also hereby expressly saves and reserves out of the grant hereby made, unto itself, its lessees, successors and assigns forever, the right to enter by itself, its or their agents, attorneys, and servants upon said lands, or any part or parts thereof, at any and all times, for the purpose of opening, developing, drilling and working mines or wells on these or other lands, and taking out and removing therefrom all such oils, gases, coal, ores, minerals, fissionable materials and fossils, and to that end it further expressly reserves out of the grant hereby made, unto itself, its lessees, successors, and assigns forever, the right by its or their agents, servants and attorneys at any and all times to erect, construct, maintain, and use all such buildings, machinery, roads, pipelines, powerlines, and railroads, sink such shafts, drill such wells, remove such soil, and to remain on said lands or any part thereof for the foregoing purposes and to occupy as much of said lands as may be necessary or convenient for such purposes hereby expressly reserving to itself, its lessees, successors, and assigns, as aforesaid, generally all rights and power in, to, and over said land, whether herein expressed or not, reasonably necessary or convenient to render beneficial and efficient the complete enjoyment of the property and rights hereby expressly reserved.

This indenture is executed subject to the covenant that no person, firm, association or corporation shall take herring spawn in waters on or over the tidelands herein conveyed, nor shall any person, firm, association, organization or corporation engage in the sale, barter or exchange of herring spawn for profit, providing however, nothing herein shall be construed to prevent or prohibit the taking of herring spawn by residents of this State for (1) personal consumption or (2) barter or exchange for the necessities of life, pursuant to A.S. 16.10.140-170 as amended.

To Have and to Hold the said land with the appurtenances thereof unto the said Grantee and their heirs and assigns forever.

In Testimony Whereof the State of Alaska has caused these presents to be executed by the Director of the Division of Lands pursuant to A. S. 38.05.035, as amended this 9th day of December, A.D. 19 74.

74-002459
$9-00

Director, Division of Lands

RECEIVED
HOMER RECORDING DISTRICT
DEC 13 1 18 PM '74
REQUESTED BY City of Homer
ADDRESS Homer Ak

State Record of Tideland Patents
Vol. IV
Page 271

TABLE 5-1

CITY OF HOMER, ALASKA

PROPERTY DESCRIPTION
OF THE INCORPORATED CITY LIMITS

UPLANDS:
(Containing 6,464 Ac. m/l)

Within Twp. 6S, Rge 14W:

The S1/2 of Sec. 13, the S1/2 of Sec. 14, and all of sections 23 and 24;

Within Twp. 6S, Rge 13W:

The S1/2 of Sec. 18, and all of sections 14, 15, 16, 17, 19, 20, 21, 22, 23, 26, 27, 28, 29, 34, 35 and 36;

Within Twp. 7S, Rge 14W

All of sections 1 and 2;

TIDELANDS
(Containing 6,831 Ac. m/l)

All tidelands lying between the Mean High Water line of Cook Inlet and Kachemak Bay and the "Directors Line", as shown on the plat of Alaska Tidelands Survey 612, filed as plat number 77-64, and further described in the Tidelands Patent No. 271, recorded in Book 80 at Page 171, all within the Office of the District Recorders Office at Homer Alaska;

Containing in all, 13,295 Ac. m/l

B. TIDELANDS

Profile

Tidelands are defined as those lands seaward of the line of mean high tide. The mean high tide line is the average of all the high tides in a given area.

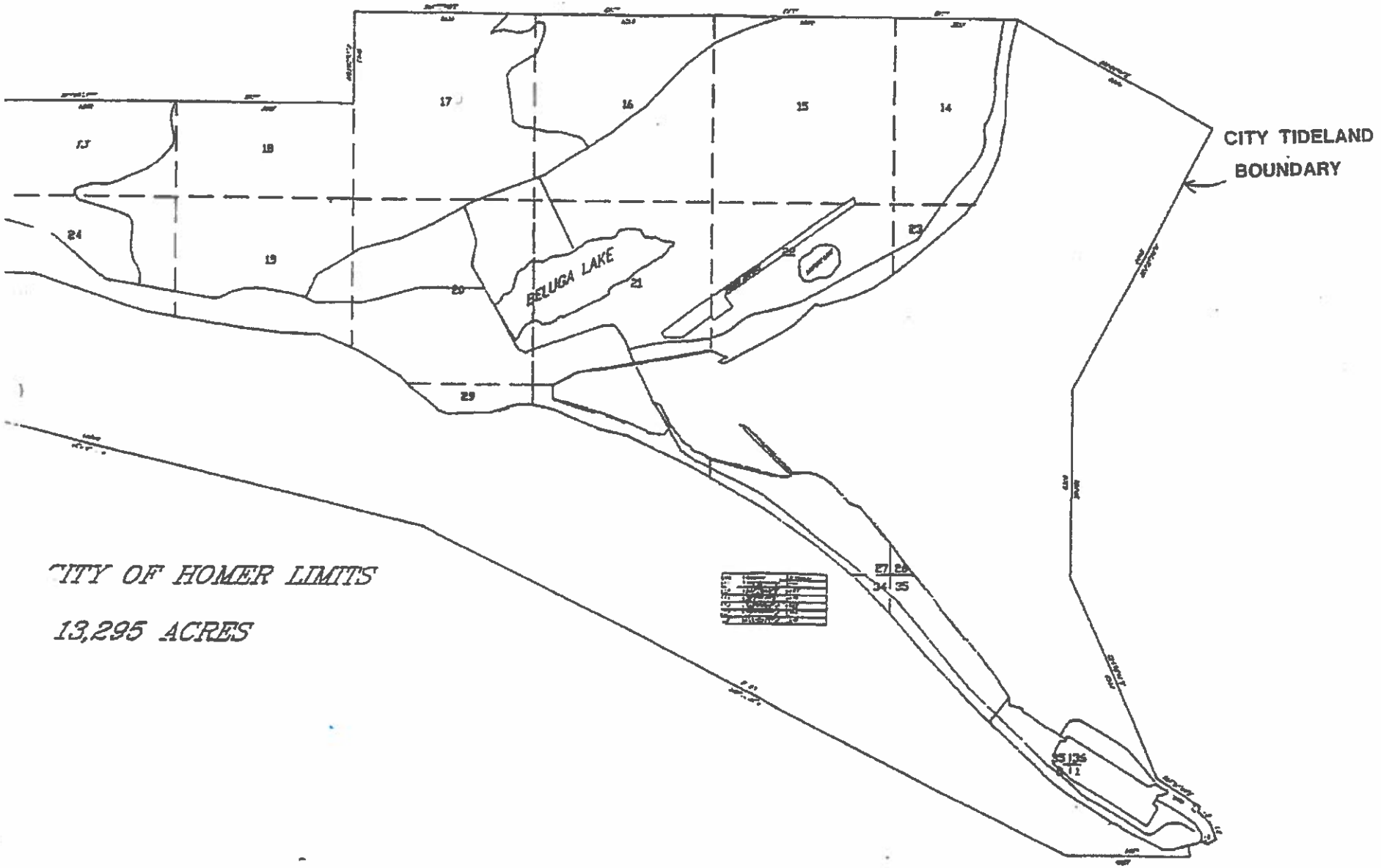
Upon becoming a State, Alaska assumed jurisdiction of all its tidelands. The first State Legislature passed a law setting forth that the State would never sell or grant away any of its tidelands. However, this same law provided that persons who had constructed or purchased certain types of buildings upon tidelands before Statehood and were using the buildings on that same date of January 3, 1959, could become eligible for a preference right and thereafter receive a patent to the tidelands.

The City of Homer applied for preference rights to all the tidelands along the City limits, and was subsequently granted title to the tidelands in 1977. The City of Homer received title to all the tidelands except for an area on the tip of the Homer Spit, which was patented to a private landowner, who also proved preference rights.

One of the conditions of municipalities receiving title to the tidelands was that they must compose an ordinance governing the tidelands. Rules governing the use of the tidelands appear in HMC Title 18.

A map and property description of the Homer tidelands follows this section.

Figure 5-2


CITY TIDELAND
BOUNDARY
BELUGA LAKE
CITY OF HOMER LIMITS
13,295 ACRES

Ordinance No. 6-730.2
City of Homer, Alaska

AN ORDINANCE OF THE CITY OF HOMER, ALASKA, PROVIDING FOR THE CONTROL OF EXCAVATION OR REMOVAL OF GRAVEL, GRAVEL FILL OR FILL MATERIAL FROM BEACHES AND OTHER AREAS WITHIN THE CITY OF HOMER: PERMITS: GUIDELINES: REVIEW: PENALTIES: DEFINITIONS.

THE CITY OF HOMER ORDAINS.....

SECTION 1. INTENT. It is the intent of this ordinance to protect and preserve the stability of that land area known as the Homer Spit and all the land areas within the corporate limits of the City of Homer which may require like protection.

SECTION 2. REFERENCE TO MATERIALS PLAT; PERMITS. The removal or excavation of gravel, gravel fill or other fill material from any beach or from any portion of the Homer Spit shall be regulated by the City. Reference shall be made in all cases to the Materials Plat prepared jointly by the State Division of Lands and the U. S. Corps of Engineers, which is available and may be examined during business hours at the Homer City Hall. A permit shall be required in the following instances:

1. Whenever gravel, gravel fill or other fill material is removed from Homer Spit or from beaches elsewhere within the corporate limits of said city.

2. Whenever such materials are removed or excavated from any naturally created berm area, or from any berm area created for the protection of said land areas.

SECTION 2. GUIDELINES. Any applicant for a permit shall comply with the following:

1. Permits shall be issued pursuant to guidelines formulated by the State Division of Lands and the U. S. Corps of Engineers, as referred to by the above-mentioned Materials Plat. Such guidelines may be altered from time to time by the Division of Lands and the Corps of Engineers as additional data is received by these agencies.

2. No permits shall be issued for excavation or removal of gravel or fill materials from area "A" as designated on the above-mentioned plat prior to review and approval of the permit application by the Corps of Engineers and the Division of Lands.

3. Permits may be issued by the City for such excavation or removal from areas "B" and "C" as designated on said plat, without review and approval of the permit application by the Corps of Engineers or the Division of Lands.

4. No permit will be issued for the excavation or removal of gravel, gravel fill or other fill materials from any area other than areas "A", "B" and "C" as designated on said materials plat.

5. All permit applications required under this ordinance shall be accompanied by a site plan showing the precise location and dimensions of the proposed excavation or removal in reasonably sufficient detail, including depth, and stating the amount of material to be excavated

LAW OFFICES OF
HAHN & JEWELL
SUITE 301
900 FOURTH AVENUE
ANCHORAGE, ALASKA
272-6324

or removed.

6. All applications required under this ordinance shall be submitted to the City Clerk, City of Homer, together with the requisite accompanying instruments, and a permit fee of Five Dollars ($5.00)

SECTION 3. EXCEPTIONS. No permit shall be required for excavation necessary for the installation of sewage lines, water lines, underground power lines, wells, oil and fuel tanks and related lines and above ground power lines from any location other than a berm area, provided such excavated material is not removed from site of construction, nor shall a permit be required for clearing or maintaining any public road.

SECTION 4. REVIEW. Any person whose application is denied shall be entitled to a review of such denial by the City Council. A request for review shall be in writing and submitted to the City Clerk within ten days of such denial. The City Clerk shall, whenever feasible, thereafter place the matter of review on the agenda for the next regularly scheduled meeting of the City Council, but in any event, such review shall not be later than the second regularly scheduled meeting after such request is received.

SECTION 5. NONLIABILITY. The City shall not be liable for damages accruing as a result of any excavation or removal of gravel, gravel fill or fill material pursuant to the issuance of a permit under this ordinance.

SECTION 6. CONFORMANCE TO PERMIT REQUIRED. Any excavation or removal of gravel, gravel fill or fill material except by permit where required shall be considered a violation of this ordinance.

SECTION 7. PENALTIES. Every person convicted of a violation of any provision of this ordinance shall be punished by a fine of not more than Three Hundred Dollars ($300.00) or by imprisonment for not more than thirty (30) days, or both such fine and imprisonment. Each act of violation and every day upon which any such violation shall occur shall constitute a separate offense.

SECTION 8. DEFINITIONS. The following words, when used in this ordinance shall, for the purpose of this ordinance, have the meanings respectively ascribed to them in this section.

EXCAVATION: The digging out and removal of gravel or other fill materials whereby any existing surface grade is altered or disturbed.

REMOVAL: The movement, by lifting, pushing aside or taking away or off of any gravel or other fill materials from any area subject to the provisions of this ordinance.

LAW OFFICES OF
HAHN & JEWELL
[illegible]
[illegible] FOURTH AVENUE
ANCHORAGE, ALASKA
272-6324

First Reading Date: November 8, 1965

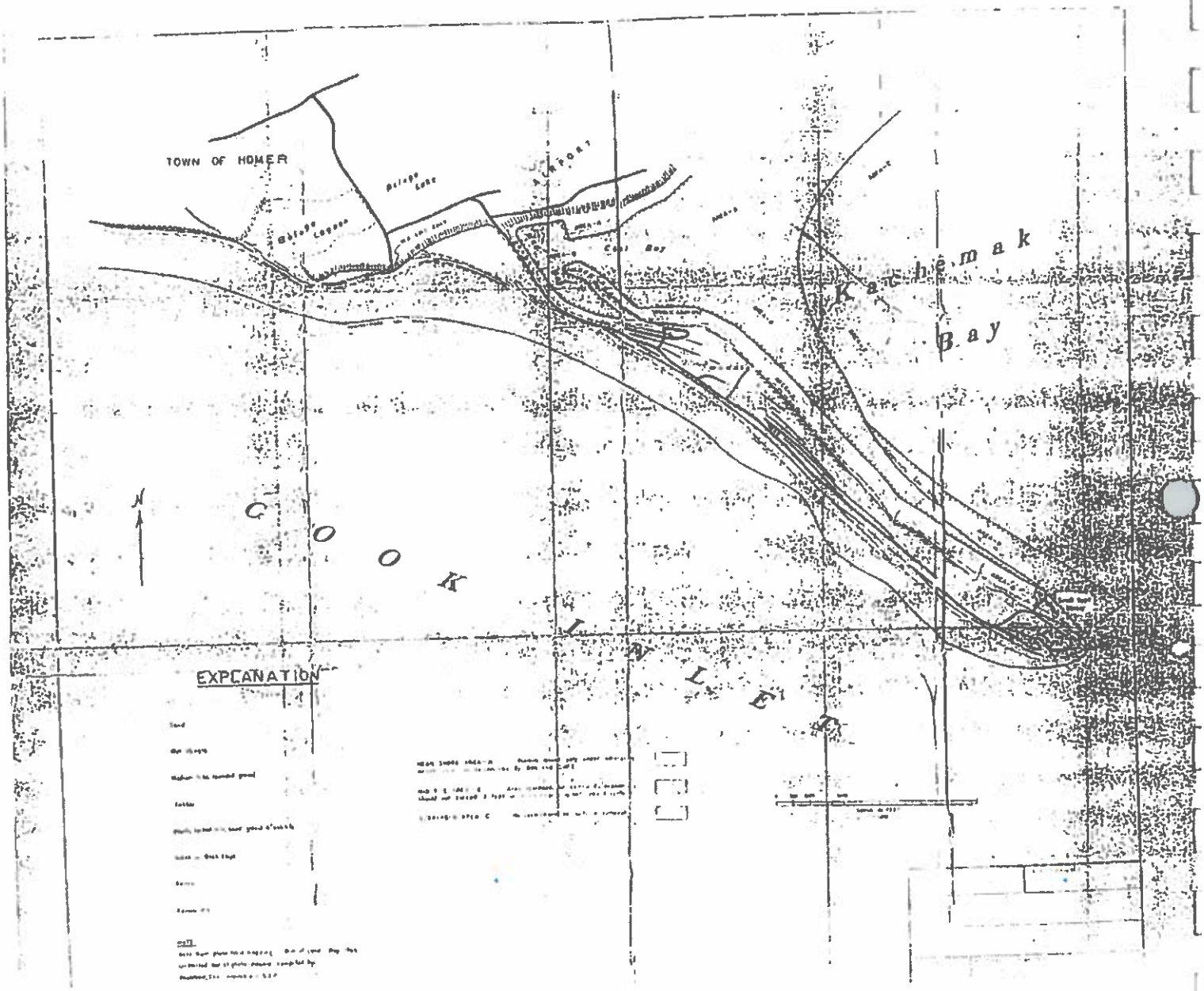
Second Reading Date: November 22, 1965

Passed and approved by the Common Council, City of Homer, this 22nd day of November, 1965.

______________________ 11-23-65
MAYOR DATE

Neida A. Calhoun 11-23-65
CITY CLERK DATE

LAW OFFICES OF
HAHN & JEWELL
SUITE 201
800 FOURTH AVENUE
ANCHORAGE, ALASKA
272-0324


TOWN OF HOMER
Kachemak
Bay
COOK
INLET
EXPLANATION

CITY OF HOMER
HOMER, ALASKA

City Attorney

ORDINANCE 98-2(A)(S)(A)

AN ORDINANCE OF THE CITY COUNCIL OF THE CITY OF HOMER, ALASKA, AMENDING HOMER CITY CODE SECTION 19.12.050 EXCEPTIONS REGARDING EXCAVATION OF HOMER SPIT BEACH.

THE CITY OF HOMER ORDAINS:

Section 1. That Homer City Code section 19.12.050, Exceptions, be amended to read as follows:

19.12.050 Exceptions. a. No permit shall be required for excavation necessary for the installation of sewage lines, water lines, underground power lines, wells, oil and fuel tanks and related lines and aboveground power lines from any location other than a berm area, provided such excavated material is not removed from site of construction, nor shall a permit be required for clearing or maintaining any public road.

b. This chapter shall not apply to the removal or excavation of gravel, gravel fill or other fill material from any beach or from any portion of the Homer Spit by the City of Homer.

Section 2. Homer City Code Section 19.12.040, guidelines, shall be amended to read as follows:

19.12.040 Guidelines. Any applicant for a permit shall comply with the following:

a. Permits shall be issued pursuant to guidelines formulated by the State Division of Lands and the U.S. Corps of Engineers, as referred to by the above-mentioned Materials Plat. Such guidelines may be altered from time to time by the Division of Lands and the Corps of Engineers as additional data is received by these agencies.

b. No permits shall be issued for excavation or removal of gravel or fill materials from area "A" as designated on the above-mentioned plat prior to review and approval of the permit application by the Corps of Engineers and the Division of Lands.

c. Permits may be issued by the City for such excavation or removal from areas "B" and "C" as designated on the plat, without review and approval of the permit application by the Corps of Engineers or the Division of Lands.

d. No permit will be issued by the City for such excavation or removal of gravel, gravel fill or other fill materials from any area other than areas "A", "B" and "C" as designated on the materials plat.

e. All permit application required under this chapter shall be accompanied by a site plan showing the precise location and dimensions of the proposed excavation or removal in reasonably sufficient detail, including depth, and stating the amount of material to be excavated or removed.

f. All applications required under this chapter shall be submitted to the City Clerk, together with the request accompanying instruments, and a permit fee of five dollars.

g. No permit shall be issued that will allow gravel, grave fill, or other fill materials to be taken off the Homer Spit. Any such materials excavated or removed anywhere on the Homer Spit shall be used only at another location on the Homer Spit.

h. Gravel for transshipment: Non-native gravel or other earthen commodities may be shipped to the Homer spit, stored on the Spit, and exported from the Spit. Gravel for transshipment must be permitted by the City of Homer. The permit shall describe the terms and timelines of the transshipment and the volumes of materials involved.

Section 3. This ordinance is of a permanent and general character and shall be included in the City Code.

ENACTED BY THE CITY COUNCIL OF THE CITY OF HOMER, ALASKA, this 23rd day of February, 1998.

CITY OF HOMER

JACK CUSHING, MAYOR

ATTEST:

MARY L. CALHOUN, CMC, CITY CLERK

AYES: 4
NOES: 0
ABSENT: 2
ABSTAIN: 0

First Reading: 01-26-98
Public Hearing: 02-09-98
Second Reading: 02-23-98
Effective date: 02-24-98

Reviewed and approved as to form and content:

Patti J. Whalin, City Manager
Date: 2-25-98

Gordon J. Tans, City Attorney
Date: 27 Feb 1998

Fiscal Note NA

CITY OF HOMER
HOMER, ALASKA

City Manager/
Port and Harbor Director

ORDINANCE 11-09

AN ORDINANCE OF THE CITY COUNCIL OF HOMER, ALASKA, AMENDING HOMER CITY CODE 19.12.020, DEFINITIONS; AMENDING HOMER CITY CODE 19.12.040, REFERENCE TO MATERIALS PLAT—PERMITS; AND AMENDING HOMER CITY CODE 19.12.050, EXCEPTIONS; REGARDING THE USE AND DISPOSAL OF DREDGE MATERIAL FROM CITY PORT AND HARBOR FACILITIES.

THE CITY OF HOMER ORDAINS:

Section 1. Homer City Code 19.12.020, Definitions, is amended to read as follows:

19.12.020 Definitions. The following words, when used in this chapter, shall have the meanings respectively ascribed to them in this section:

a. "Beach area" means the zone of sand, gravel and other unconsolidated materials that extends landward from the low water line to the place where there is a marked change in material or physiographic form.

b. "Berm" means a natural, linear mound or series of mounds of sand or gravel, or both generally paralleling the water at or landward of the line of ordinary high tide.

c. "Dredge material" means earth, sand or gravel that is removed from below the low water line in City port and harbor facilities.

d. "Excavation" means the digging out and removal of gravel or other fill materials whereby any existing surface grade is altered or disturbed.

e. "Removal" means the movement, by lifting, pushing aside or taking away or off of any gravel or other fill materials from any area subject to the provisions of this chapter.

f. "Storm berm" means a berm formed by the upper reach of storm wave surges or the highest tides. Storm berms generally include an accumulation of seaweed, driftwood, and other water-borne materials. A beach may have more than one storm berm.

Section 2. Homer City Code 19.12.030, Reference to materials plat--Permits, is amended to read as follows:

19.12.030 Reference to materials plat—Permits. The removal or excavation of gravel, gravel fill or other fill material from any beach or from any portion of the Homer Spit shall be regulated by the City. Reference shall be made in all cases to the Materials Plat prepared jointly by the State Division of Lands and the U. S. Corps of Engineers, which is available and may be examined during business hours at the Homer City Hall. Except as provided in §19.12.050, a permit shall be required in the following instances:

a. Whenever gravel, gravel fill or other fill material is removed from Homer Spit or from beaches elsewhere within the corporate limits, of the City;

b. Whenever such materials are removed or excavated from any naturally created berm area, or from any berm area created for the protection of the land areas.

Section 3. Homer City Code 19.12.050, Exceptions, is amended to read as follows:

19.12.050 Exceptions. a. No permit shall be required for excavation necessary for the installation of sewage lines, water lines, underground power lines, armor rock or piling, wells, oil and fuel tanks and related lines and aboveground power lines from any location other than a berm area, provided such excavated material is not removed from site of construction, nor shall a permit be required for clearing or maintaining any public road.

b. This chapter shall not apply to the removal or excavation of gravel, gravel fill or other fill material from any beach or from any portion of the Homer Spit by the City of Homer.

c. This chapter shall not apply to dredge material placed or stored on the Homer Spit by the City of Homer. The City may provide for the use and disposal of such dredge material in the following order of priority, with all proceeds from sales of dredge material being deposited in the Port/Harbor Enterprise Fund:

1. Replacement of material removed from City beaches by storms or erosion.
2. Fill to improve City port and harbor facilities on the Homer Spit.
3. Sale for use as fill on privately owned or leased property on the Homer Spit.
4. Emergency repairs of erosion.
5. Sale for use as fill material at locations off the Homer Spit.

Section 4. This Ordinance is of a permanent and general character and shall be included in the City Code.

ENACTED BY THE CITY COUNCIL OF HOMER, ALASKA, this 14th day of March, 2011.

CITY OF HOMER

JAMES C. HORNADAY, MAYOR

ATTEST:

JO JOHNSON, CMC, CITY CLERK

YES: 6
NO: ~~0~~
ABSTAIN: ~~0~~
ABSENT: ~~0~~

First Reading: 2/28/11
Public Hearing: 3/14/11
Second Reading: 3/14/11
Effective Date: 3/15/11

Reviewed and approved as to form:

Walt E. Wrede, City Manager

Date: 3/18/11

Thomas F. Klinkner, City Attorney

Date: 3-22-11

Appendix C

Historical Synopsis of Homer Spit Erosion
and
Associated Corrective Measures

Historical Synopsis of Homer Spit Erosion and Associated Corrective Measures

Historically, Homer Spit's coastline morphology has been modified to support the coal industry, to fuel and support sea-going vessels, and to provide for commercial development and recreation opportunities. Geophysical and storm events have also been associated with causing dramatic changes in Homer Spit's coastline. Especially problematic has been and continues to be the beach erosion on the spit's Cook Inlet, west-facing side (Figure 1).

Figure 1. Location of historically a shoreline erosion problem on Homer Spit, AK.

Defining the nature of Homer Spit's erosion

One of the first attempts to document the extent of beach erosion on the Homer Spit was performed by Stanley and Grey (1963). In their pre-1964 earthquake report, Stanley and Grey determined the extent of erosion and appraised the U.S. Army Corps of Engineers, Alaska District (Corps) of the problem, which centered on the west-facing side of Homer Spit. Stanley and Grey's findings determined that the spit's state of permanency is primarily a function of two variables: (1) the rate of erosion along the northwest shoreline; and (2) the transportation ability, via wind and wave action, of the littoral drift. Indiscriminately altering either variable to control erosion would be detrimental to the spit's morphology Stanley and Grey (1963).

Later historical analyses of erosion along the Homer Spit were complicated by the 1964 earthquake, which lowered the spit elevation by several feet and greatly accelerated the spit's shoreline erosion. However, after the 1964 earthquake the spit entered a rebuilding phase, which partially masked the continuing erosion problems when other studies were conducted.

Gronewald and Duncan (1965) presented information regarding the rapid acceleration of the erosion process due to the subsidence of the Homer Spit during the 1964 earthquake. In those areas eroding before the earthquake, the problem after subsidence was accelerated. Waller (1966) and Stanley (1966) also documented the erosion problem along the southwestern shore of the spit, as affected by the 1964 earthquake, and collaborated Gronewald and Duncan (1965) findings.

In 1974, the Corps determined that since the 1964 earthquake, natural forces were in apparent equilibrium as a result of soil rebound and materials added to the littoral conveyor by wave action against the nearby bluffs. In general, the Corps concluded that the Homer Spit shoreline was stable and remained so for the past three years due to rebound and engineered shoreline protection features (USACE, 1974).

Woodard-Clyde (1980) provided limited data on circulation and preliminary estimates of sediment transport patterns and reported that: (1) much of the sediment that is transported towards the distal point along Homer Spit's southwest shore is deposited in deep water or to the Archimandritof Shoals; (2) the absence of a sub-aqueous shoal of sediment around the spit's distal point indicates that relatively small volumes of sediment are transported in the subtidal zone around the distal point onto the northeast shore; and (3) within the intertidal zone, sediments move alongshore by the effects of wave-induced/wind-generated littoral currents and also migrate onshore and offshore as wave conditions vary.

Peratrovich *et al.* (1982) reviewed existing literature and analyzed changes induced in the amounts of sand being deposited on or eroded from the Homer Spit; i.e. the sand budget. Their findings determined that most reports, including their field study findings, indicated that in the long term, Homer Spit is accreting along its southwest edge.

The Corps conducted four field beach surveys (August 1984, 1985 & 1986 and May 1986) on Homer Spit to determine Federal Operation and Maintenance (O&M) responsibilities (Chu *et al.*, 1987). Beach elevations in front of the Federal revetment would determine beach nourishment requirements, as periodic beach nourishment was suppose to minimize down drift erosion of Homer Spit. During the 2-year study period, erosion at southwestern shore of Homer Spit was determined to not be excessive. Minor accretion was found to be occurring at the base of the spit, including at the segment where a steel sheet-pile seawall had been erected. Study findings also noted that there was a need for beach nourishment in front of the existing seawall to modify the local bathymetry and promote wave breaking during storm events. Other Corps studies also determined that large year-to-year fluctuations in the spit's beach erosion and littoral processes vary according to location (USACE, 1990). In some years erosion occurred near the distal end

of the spit while in most of the other years, moderate erosion occurred toward the middle of the spit, with accretion near the distal end.

Between 1999 and 2008, the Corps monitored beach erosion in front of the most historically problematic areas – the stretch of beach in front of a rock revetment protecting a steel sheet-pile wall. Collectively all the subject year's beach monitoring data indicate that no appreciable amounts of erosion is occurring in front of the sheet-pile protected area or other known problematic areas on the Homer Spit (Jeffries, personal communication).

Engineering attempts to manage Homer Spit's erosion

The Homer Spit Road, constructed in 1927 and predated by a railroad built in the 1890's to serve a coal exporting operation, has repeatedly been damaged by storms. The inshore half, northwest shoreline of the Homer Spit Road leading to the developed end of the spit, has been most susceptible to damage and erosion. Between 1966 and 1982, the State of Alaska spent over $6 million on emergency road repairs (USACE, 1990).

Prior to the 1964 earthquake, the State of Alaska constructed four timber beach groins along critical shoreline locations on the Homer Spit. The timber beach groins were constructed perpendicular to the beach at the northwest section of the Homer Spit with the intention of trapping material moving in a long-shore direction to the tip of the spit and therefore, protecting the Homer Spit Road (Figure 2).

Stanley and Grey (1963) found that considerable shoreline "filling" occurred at three of the four groins, and noted that: (1) Groin No. 3 demonstrated the effectiveness of filling on the up-drift side (Figure 3); (2) Groin No. 4 illustrated the effect of erosion along the landward end of the groin the destructive type of wave action along the down drift side (Figures 4 and 5). To protect this area, the then Alaska Department of Highways placed heavy riprap along the shoreline and elsewhere lined the shoreline with old car bodies (Stanley and Grey, 1963). The car bodies (which no longer exist) provided some protection but within weeks after the earthquake, large waves scattered the car bodies and groin-associated rock riprap about the beach (Stanley, 1966).

Corps studies, post-1964 earthquake, also determined that the groins trapped an excessive amount of littoral drift while depleting the remaining beach of gravels and sands required for nourishment (USACE, 1964). It was particularly noted that the beach on the down-drift side of the most distal groin (No. 4) had been eroding (Gronewald and Duncan, 1965). To prevent further erosion and damage to the Homer Spit Road, a timber bulkhead at No. 4 groin was built and extended along the beach for approximately 600 feet and two semi-adjustable timber groins (No. 5 and No. 6) (Figure 2) were constructed and attached to the bulkhead (Gronewald and Duncan, 1965). The original four groins, particularly No. 3 and No. 4 were determined to be overly long and were trapping unnecessary quantities of material; therefore, to allow more

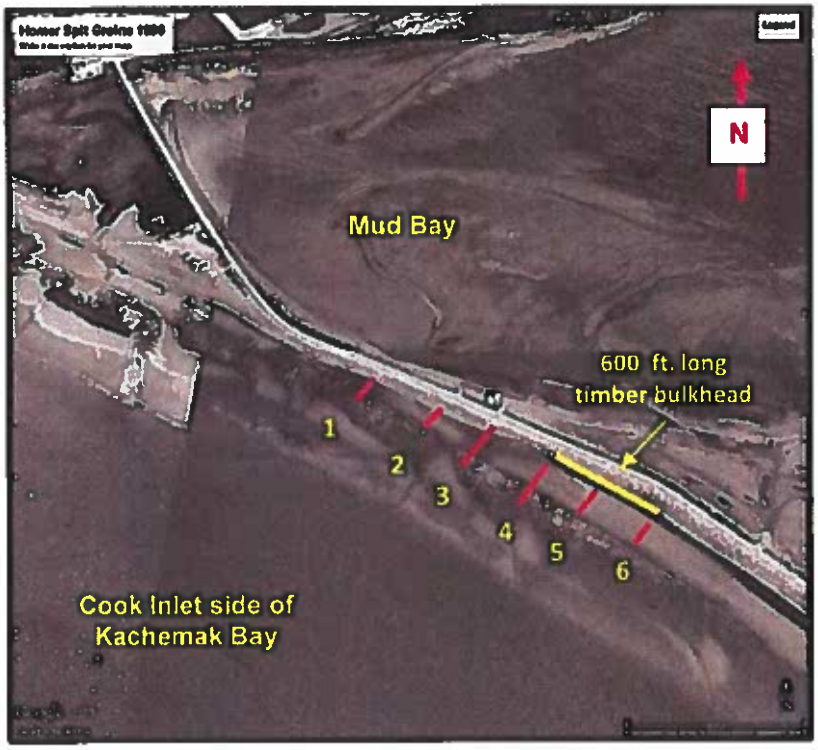


Figure 2. Location of historically constructed wooden timber groins and wooden bulkhead on Homer Spit, AK. Groins 1 through 4 were constructed before 1963. In 1964 or 1965, Groin No. 5 and no longer existing Groin No. 6 were constructed next to a no longer existing 600 foot long timber bulkhead.

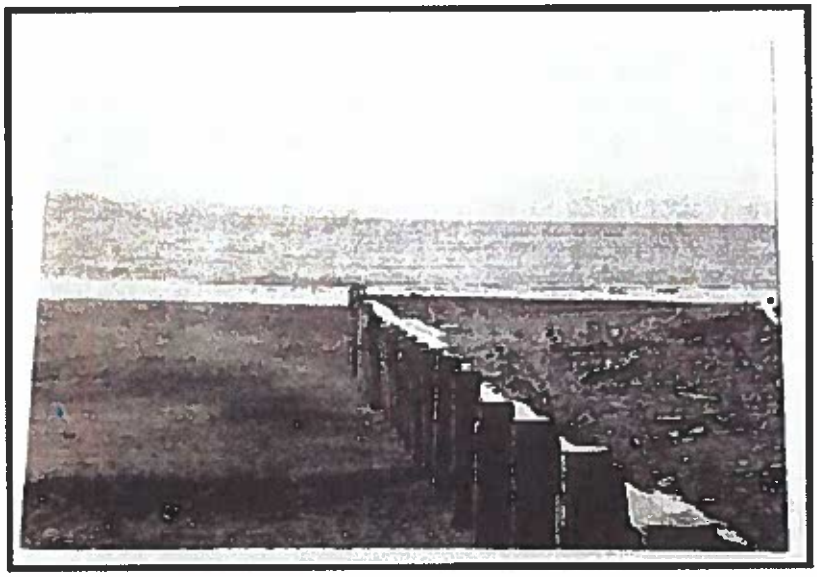


Figure 3. 1963 Photograph of Groin No. 3 taken in 1963, demonstrating the effectiveness of filling on the up-drift side, Homer Spit, AK. (Stanley and Grey, 1963).

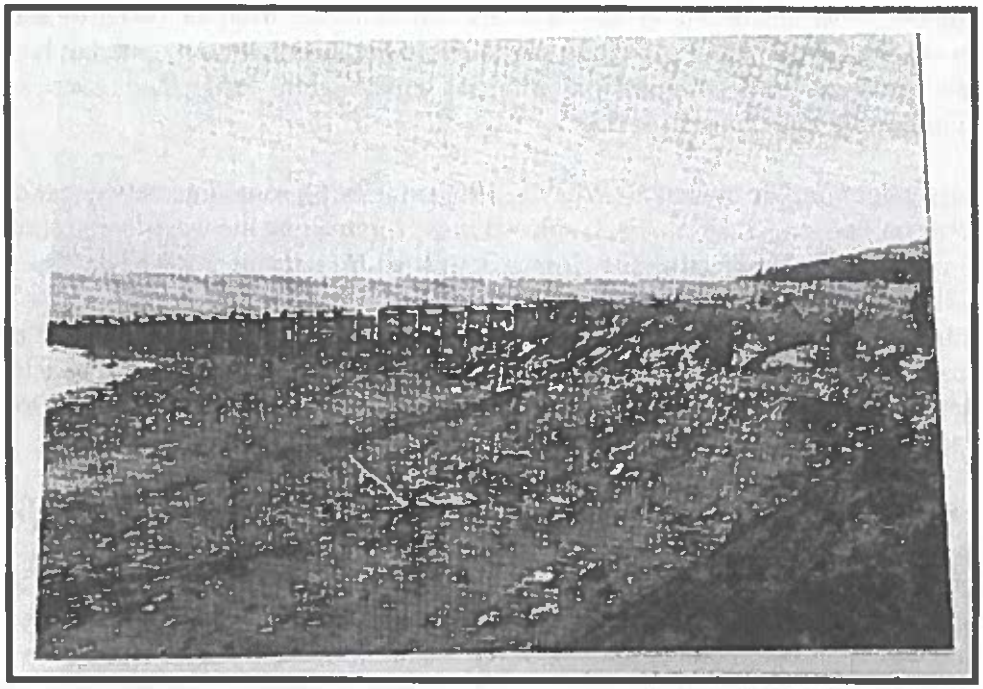


Figure 4. 1963 Photograph of Groin No. 4 taken in 1963, illustrating the effect of erosion along the down drift and landward end of the groin, Homer Spit, AK. (Stanley and Grey, 1963).

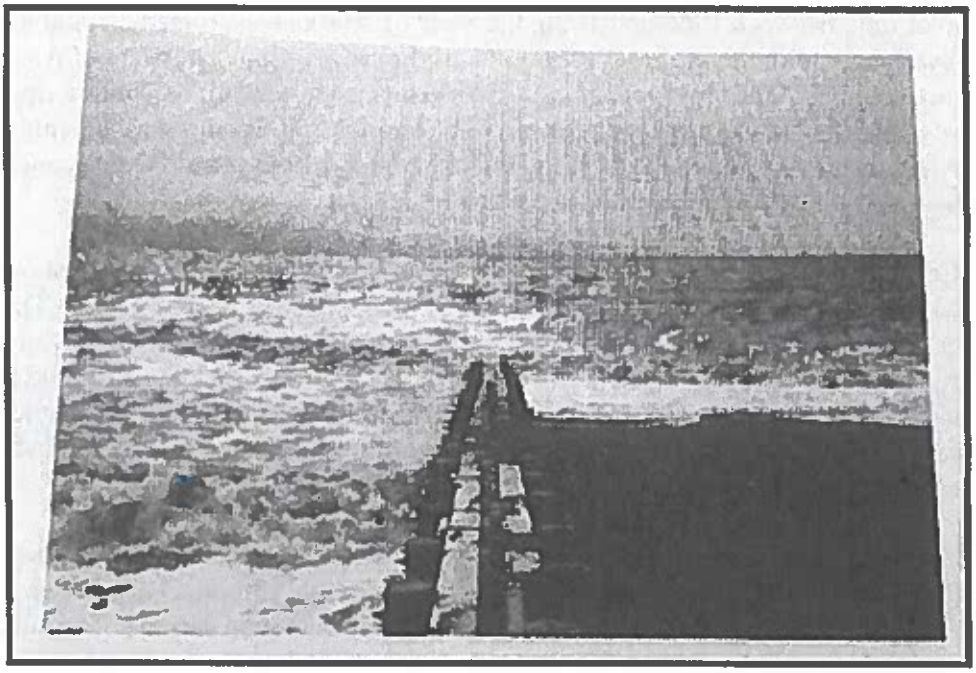


Figure 5. 1963 Photograph of Groin No. 4 taken in 1963, illustrating the destructive type of wave action along the down drift side, Homer Spit, AK. (Stanley and Grey, 1963).

material to migrate down the beach 50-foot sections were removed from the two groins. (Figure 6). The area between groin No. 5 and No. 6 was observed collecting beach material; however, groin No. 6 failed because of a combination of hurried construction, design, and severe storms (Figure 7). (Gronewald and Duncan, 1965).

Based on Corps photographic evidence (Weaver, 1965 and 1966), sometime between March 1965 and October 1966, the State of Alaska placed rock riprap along the west-facing shoreline of the Homer Spit in hopes of protecting the Homer Spit Road from being eroded away by storms (Figure 8). Ultimately, the five remaining timber groins were found to be contributing to the Homer Spit Road maintenance problem because they were disrupting the continuity of sediment transport along the spit's western shoreline. Consequently, all the groins' wooden panels that weren't destroyed by the 1964 earthquake or storms were dismantled sometime after 1965, and only their wood pilings remain visible today (Figure 9).

In 1963, the Corps was Congressionally authorized to conduct the Kachemak Bay Beach Erosion Study for the purposes of determining, "...the advisability and extent of Federal participation in remedial measures that can be taken to prevent erosion and to stabilize Homer Spit." (USACE, 1964). The Corps concluded that because Homer Spit's shoreline was primarily privately owned and no erosion was apparent, there was a lack of justification for Federal participation in erosion control at this time; therefore, no alternatives were evaluated or appraised for cost and effect (USACE, 1974). The report went on to conclude that the best solution for controlling future erosion was, "...prompt application of nonstructural measures, such as zoning, building codes, and strict control of gravel borrow from the beaches".

Over a period of time between 1966 and 1986, the State of Alaska constructed a 5,400 foot long armor rock revetment along the northwest shoreline of the Homer Spit. The State of Alaska in 1980 also constructed a 1,000-foot long cantilevered steel sheet pile wall, flanked by riprap, in a highly erosive shoreline area to protect a section of the Homer Spit Road. The sheet pile wall subsequently failed and was repaired twice, the last time after a 1982 storm when a concrete block revetment was place at the toe of the steel sheet pile wall.

In 1983 the Corps was Congressionally authorized, "... to undertake a study (in Fiscal Year 1984) on a permanent solution of serious erosion conditions at Homer Spit, Alaska." The Corps produced a Letter Report (USACE, 1984) in which they conducted a literature review of past studies of the Homer Spit erosion problem, including those performed by the Corps and those done by or under the sponsorship of the Alaska Department of Transportation and Public Facilities (ADOT/PF). The Corps also concluded that it address the erosion problem under its General Investigation authority.

The Corps' Reconnaissance Study (USACE, 1985) included the Corps' Coastal Engineering Research Center analysis of the forces acting upon the Homer Spit (Smith, *et al.*, 1985). In concert, the State of Alaska performed beach and offshore cross section surveys. The alternatives

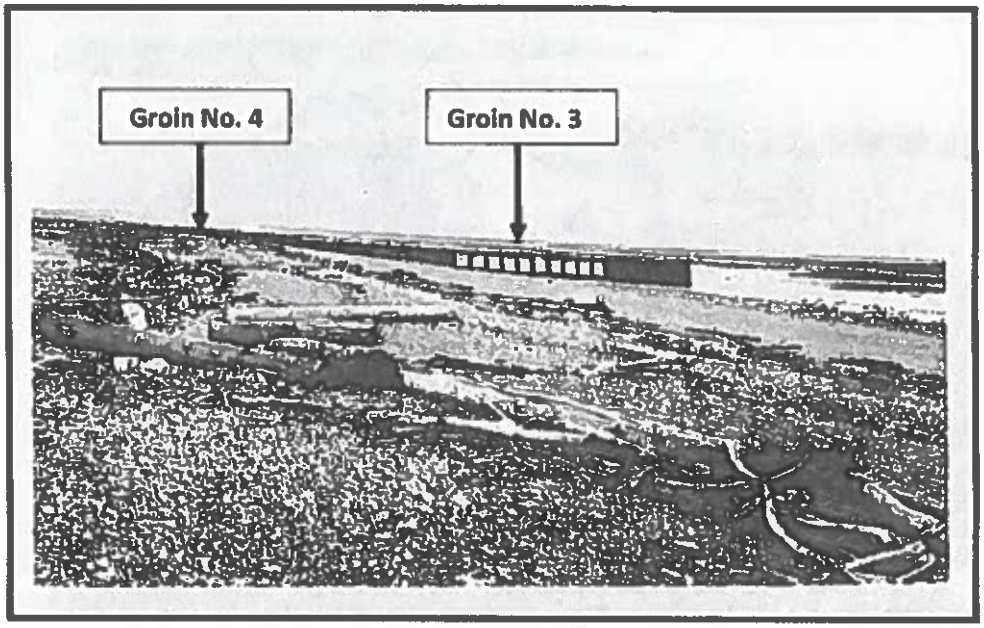


Figure 6. Photograph taken in June 1965 illustrating Groin No. 3 on Homer Spit having been open opened up by cutting with a chain saw. Barely visible in the far background is opened up Groin No. 4 (Gronewald and Duncan, 1965).

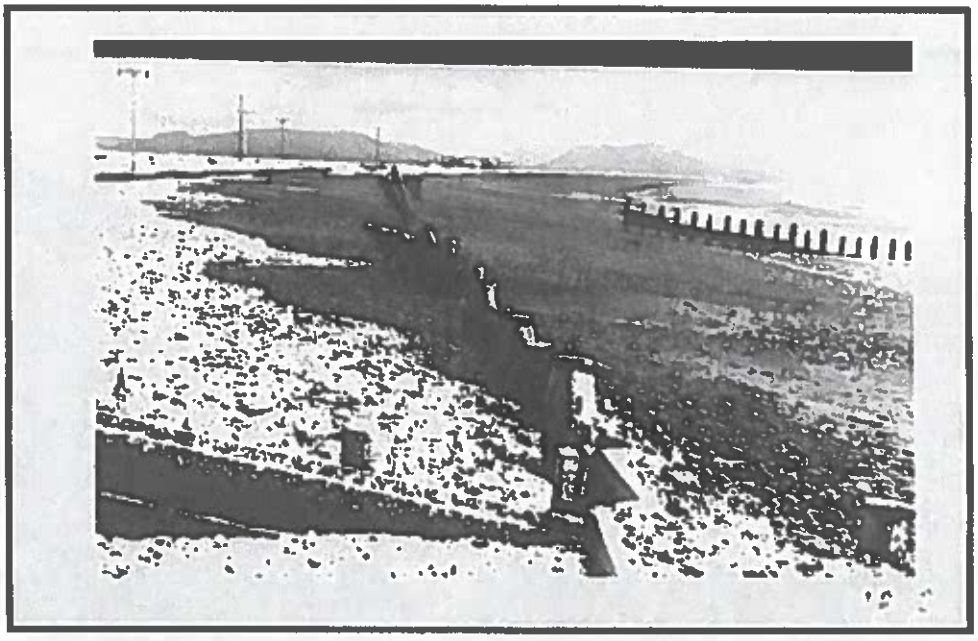


Figure 7. Photograph taken in 1965 illustrating the destructive nature of a storm that destroyed Groins No. 5 (not in photograph), No. 6 (shown in upper right corner) and the wooden headwall (shown in the center of the photograph), Homer Spit, AK. (Weaver, 1965).

Figure 8. Photograph taken in 1966 of the rock riprap placed along the shoreline in proximity to Groin No. 1, Homer Spit, AK. (Weaver, 1966).

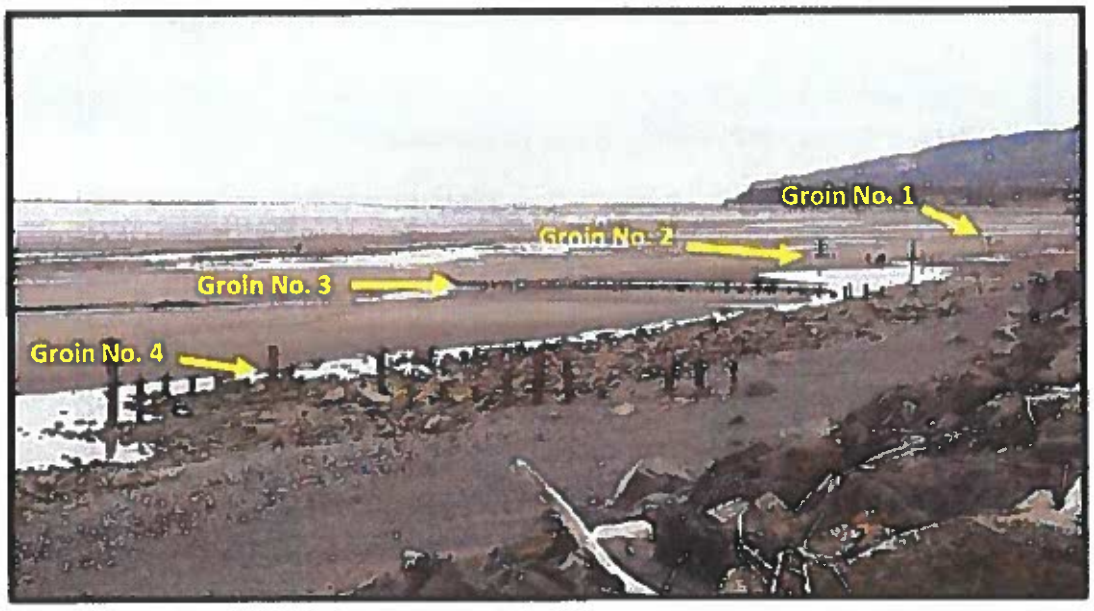


Figure 9. Photograph taken in 2012 of historically constructed wooden timber groins on Homer Spit, AK.

considered during the survey were grouped under two main headings: structural and non structural. Based on the level of information available at that time, it appeared that a uniformed beach fill and revetment extension alternative had the highest net benefits; therefore, the Corps recommended that a detailed feasibility study be initiated (USACE, 1985).

A Draft Storm Damage Reduction Interim Feasibility Report identified the most economical solution which addressed the problem at Homer Spit was extending the existing rock revetment through the threatened area (USACE, 1987). Although a beach fill would address erosion over the long term, it was determined to be more economical to extend the revetment than renourish the beach area.

In 1990, the Corps finalized its Storm Damage Reduction Interim Feasibility Report and recommended potential permanent solutions to Homer Spit's beach erosion, including the aforementioned failed sheet pile wall (USACE, 1990). The Corps recommended extending the existing rock revetment 1,130 feet through the threatened area along with placing beach fill to nourish the severely eroded beach in front of the protective structure. It was also determined to be economically feasible to periodically provide beach nourishment should beach monitoring determined it to be necessary, which could be as soon as in project-year 10 and every 10 years thereafter.

The Corps conducted a field trip to the Homer Spit in August 1993, in response to ADOT/PF concern about damage and the spit's potential for "surviving the winter" (USACE, 1993). During the trip it was revealed that an accelerated episode of erosion had occurred along the toe of the steel sheet pile wall during a 1992 winter storm, i.e. a scour hole approximately 5 feet deep by 25 feet wide had formed and two concrete guardrail posts had lost their foundation and were hanging in mid-air, supported only by the guardrail. A September 16, 1993, stormed caused a much larger scour hole to form and the guardrail collapsed into the scour hole. A temporary "fix" occurred within days of the September 1993 storm when 1,500 cubic yards of pit-run gravel was placed in the damaged area as "sacrificial fill" in hopes of lasting through the winter. Soon after the fill material was placed, an October 16, 1993, storm hit the Homer Spit. Even though some erosion damaged occurred, the sacrificial fill functioned properly, i.e. the steel sheet pile held and the Homer Spit Road was not damaged. A second temporary fix was undertaken after the October 1993 storm. Pit-run gravel was again used to rebuild selective shoulder sections of the Homer Spit Road, a strong highly permeable filter fabric was put down on eroded areas and covered with armor stone scavenged from the beach, and a row of concrete blocks relocated from an 1982 failed revetment were placed along the shoreline crest next to the armor stone (Figure 10). The fix was expected to last through any remaining 1993 winter storms until a permanent project was built (USACE, 1993).

Figure 10. Photograph taken June 18, 1994, when the 1,130 foot long rock revetment was being constructed by the U.S. Army Corps of Engineers. The photograph also shows in the foreground the State of Alaska's 1993 temporary shoreline protection measure which included using pit gravel, concrete blocks, filter fabric, and armor stone to protect the Homer Spit Road.

Based on the 1993 storm events, the Corps prepared a supplement to its Homer Spit Final Storm Damage Reduction Interim Feasibility Report to include a 300-foot long transition revetment to stabilize the distal end of the Corps' 1,130-foot long rock revetment (USACE, 1993). The Corps completed a "permanent project" in August 1994 when a 1,430-foot rock revetment/transition was constructed and rock was relocated along the side of the Homer Spit Road for 1,200 feet (Figure 10).

A storm in early November 1994 with 40-knot winds in conjunction with extremely high tides hit Homer Spit but the Corps' revetment and rock relocation area showed no signs of erosion. It was noted, however, that at the end of the rock relocation area parts of the Homer Spit Road shoulder eroded away. The Corps in 1996 completed a Design Memorandum (USACE, 1996) addressing the November 1994-related storm damage problems along the shoulder of the Homer Spit Road. As a result, the Corps extended the existing rock revetment/transition area 4,200 feet in September 1998 (Figure 11).

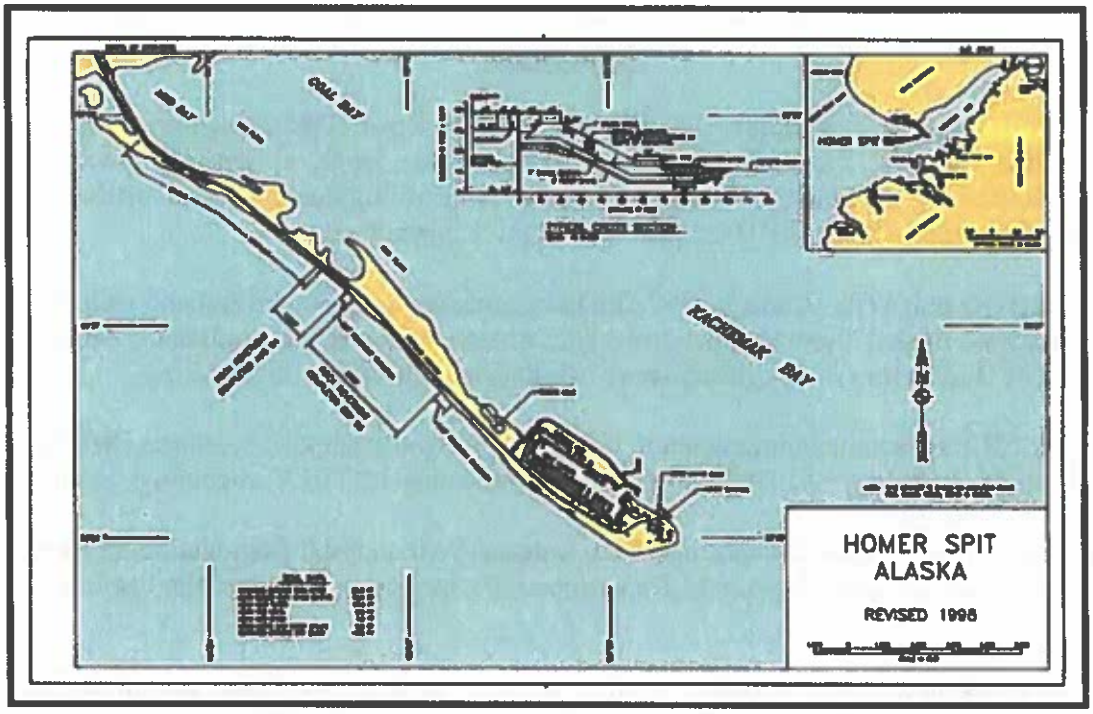


Figure 11. Federal shoreline protection measures constructed on Homer Spit, AK.

A review of the literature and Corps files indicates that since 1998, no additional engineering efforts have been attempted or made to further control shoreline erosion on the west-facing, Cook Inlet side of the Homer Spit.

References

Chu, Y., M.B. Gravens, J.M. Smith, L.T. Gorman and H.S. Chen. 1987. Beach Erosion Control Study, Homer Spit, AK. Coastal Engineering Research Center, Dept. of Army Waterways Experiment Station, Vicksburg, MS. for U. S. Army Corps of Engineers, Alaska District. Miscellaneous Paper CERC-85-15. September. 36 pp. + appendices.

Gronewald, G.J. and W.W. Duncan. 1965. Study of Erosion along Homer Spit and vicinity, Kachemak Bay, Alaska. Presentation at the ASCE Coastal Engineering Conference, Santa Barbara, CA. U.S. Army Corps of Engineers, Alaska District.October 1965. 11 pp.

Jeffries, A. 2013. Personal communication. U.S. Army Corps of Engineers, Alaska District. Civil Works Branch, Hydrology and Hydraulics Section. December 12, 2013. Anchorage, Alaska.

Peratrovich, Nottingham and Drage, Inc. 1982. Littorial Drift and Spit Degradation on Homer Spit, Alaska. Interim Report for Alaska Department of Transportation and Public Facilities. 18 pp.

Smith. O.P., J.M. Smith, M.A. Cialone, J. Pope, and T.L. Walton. 1985. Engineering Analysis of Beach Erosion at Homer Spit, Alaska. Coastal Engineering Research Center, Dept. of Army Waterways Experiment Station, Vicksburg, MS. for U. S. Army Corps of Engineers, Alaska District. Miscellaneous Paper CERC-85-13. September. 162 pp.

Stanely, K.W. 1966. Beach Changes on Homer Spit in "Effects of the Earthquake of March 27, 1964 in the Homer Area, Alaska" by R. M. Waller. U.S. Geological Survey Professional Paper 542-D. 28 pp.

Stanely, K.W. and H.J. Grey. 1963. Preliminary Report: Beach Erosion Study of the Homer Spit and Adjoining Shoreline, Alaska. Department of Natural Resources, State of Alaska. June. 12 pp.

U.S. Army Corps of Engineers, Alaska District. 1996. Homer Spit Repair and Extension – Alaska. Design Memorandum. Anchorage, AK. April. 8 pp. + figures and appendices.

_____ . 1993. Homer Spit Storm Damage Reduction. Final Interim Feasibility Report - Supplement. Anchorage, AK. December. 7 pp. + appendices.

_____ . 1990. Homer Spit Storm Damage Reduction. Final Interim Feasibility Report with Engineering Design and Environmental Assessment. Anchorage, AK. June. 76 pp. + appendices.

_____ . 1989. Homer Spit Storm Damage Reduction. Final Feasibility Report with Engineering Design and Environmental Assessment. Anchorage, AK. June. 69 pp. + appendices.

_____ . 1987. Homer Spit Storm Damage Reduction. Draft Interim Feasibility Report, Volume 1 and Environmental Assessment. Anchorage, AK. December. 62 pp.

_____ . 1985. Homer Spit Beach Erosion, Reconnaissance Report, Volume 1. Anchorage, AK. October. 26 pp.

_____ . Homer Spit Beach Erosion, Letter Report. Anchorage, AK. February. 7 pp. + appendices.

_____ . 1974. Beach Erosion Control, Kachemak Bay – Homer Spit, Alaska. Feasibility Report. August. 17 pp. + appendices and plates.

_____ . Plan of Study – Study Control System, Kachemak Bay Beach Erosion Study, Alaska. Anchorage, AK. July. 4 pp. + appendices and plates.

Waller, R. 1966. Effects of the Earthquake of March 27, 1964 in the Homer Area, Alaska. Geological Survey Professional Paper 542-D, U.S. Government Printing Office, Washington, D.C.

Weaver, Monte. 1966. Homer Spit, Project Number F-021-1(14). Photographs taken October 14, 1966. Administrative Files. Hydrology and Hydraulics Section, Technical Services Branch. U.S. Army Corps of Engineers, Alaska District. Anchorage, AK.

_____ . 1965. Homer Spit Photographs, March 1965. Administrative Files. Hydrology and Hydraulics Section, Technical Services Branch. U.S. Army Corps of Engineers, Alaska District. Anchorage, AK.

Woodward-Clyde Consultants. 1980. Homer Spit Littoral Drift Studies. for U.S. Army Corps of Engineers, Alaska District. January. 69 pp. + appendices.

Appendix D

Summary of Environmental Impacts Associated with Dredged Material Management Categories Homer Spit, Alaska

Summary of environmental impacts associated with dredged material management categories, Homer Spit, AK.

Dredged Material Management Categories	Fish and Wildlife Resources of Primary Concern						
	Marine Benthos	Marine Mammals	Fishery Resources and Essential Fish Habitat (EFH)	Water Quality	Avians	Endangered and Threatened Species	Comment
Existing Upland Dredged Material Storage Site	No adverse direct, indirect or cumulative impacts.	No adverse direct, indirect or cumulative impacts.	No adverse direct, indirect or cumulative impacts.	No adverse direct, indirect or cumulative impacts.	No adverse direct, indirect or cumulative impacts	No adverse direct, indirect or cumulative impacts.	Site is in proximity to camping/RV parking areas and commercial developments. Conflicting land uses.
Parking Pads Development	No adverse direct, indirect or cumulative impacts.	No adverse direct, indirect or cumulative impacts.	No adverse direct, indirect or cumulative impacts.	No adverse direct, indirect or cumulative impacts.	No known avian nesting on site. Transient use of native vegetation would be lost.	No adverse direct, indirect or cumulative impacts.	No fill placed below mean high tide (+23.4 feet). Beach rye grass habitat within project footprint permanently destroyed.

Dredged Material Management Categories	Marine Benthos	Marine Mammals	Fishery Resources and Essential Fish Habitat (EFH)	Water Quality	Avians	Endangered and Threatened Species	Comment
Beach Nourishment	Material indiscriminately placed would bury epifauna in tide pools and on cobble substrate; and sand bar infauna.	Sea otters, which are commonly found in nearshore waters, would not be adversely impacted by placing material on the beach at low tide.	Nearshore fish populations not impacted with placement of material at low tide. Suspended solids could settle on feeding resources for EFH species.	Short term increase in turbidity and suspended solids associated with placing material on the beach at low tide. No long term adverse impacts.	Nearshore feeding shorebirds would be temporarily displaced from intertidal areas while placing material on beach at low tide.	Steller's eider, a threatened sea duck species, would not be affected by placing material on beach at low tide, as the species is not present Mar.-Nov.	Dredge material would be placed at the toe of rock revetments and/or on the offshore sand bars, avoiding the nearshore tide pools and bands of cobble habitat.
Offshore Disposal	Gravelly dredge material would bury epifauna and infauna inhabiting on and in soft bottom habitat.	Disposal operations temporarily displace sea otters, harbor seals, and a variety of whale species due to generated noises and turbidity plumes.	Offshore fish populations temporarily displaced from area of deposition due to turbidity plume. Suspended solids would settle on feeding resources for EFH species.	Short term turbidity generated when placing material into the water column. No long term adverse impacts expected.	Vessel traffic to and from the disposal site would temporarily displace individual and rafts of resting/feeding sea ducks using the area.	Steller's eider, a threatened sea duck species, would not be affected by offshore disposal activities, as the species is not present Mar.-Nov.	Federal regulations regarding offshore disposal would require a thorough investigation of potential impacts prior to implementation.
New Harbor Staging Area	Gravelly dredge material would permanently bury epifauna and infauna inhabiting on-and-in soft bottom habitat and patches of cobble/boulder habitat within the project footprint.	Sea otters, which are commonly found in Kachemak Bay and feed/rest in the project area, would be permanently displaced during and after the construction of the dredged material disposal/ staging area.	Offshore and nearshore fish populations and EFH permanently lost from fill area footprint. During construction turbidity plume displaces fishery resources form the area. A rock revetment would provide near-shore fishery habitat.	Short term turbidity generated when constructing the dredged material disposal/staging area and placing the material into the facility. Nearshore circulation pattern on east side of Spit expected to change.	Nearshore and intertidal feeding areas for shorebirds and seas ducks would be permanently lost when constructing the dredged material disposal/ staging area.	Steller's eider, a threatened sea duck species, and its habitat would be impacted by constructing the dredged material disposal area.	The construction of the dredged material disposal/ staging area is related to the City of Homer's desire to construct an additional small boat harbor at the end of Homer Spit.