US Army Corps of Engineers®

Draft Integrated Feasibility Report and Supplemental Environmental Assessment

Port of Nome Modification Feasibility Study
Nome, Alaska

December 2019

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Nome, Alaska

Prepared by
U.S. Army Corps of Engineers
Alaska District

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EXECUTIVE SUMMARY

This General Investigations study is being conducted under authority granted by Section 204 of the Flood Control Act of 1948, which authorizes a study of the feasibility for development of navigation improvements in various harbors and rivers in Alaska. This study is also utilizing the authority of Section 2006 of WRDA, 2007, Remote and Subsistence Harbors, as modified by Section 2104 of the Water Resources Reform and Development Act of 2014 (WRRDA 2014) and further modified by Section 1105 of WRDA 2016. Section 2006 states that the Secretary may recommend a project without demonstrating that the improvements are justified solely by National Economic Development (NED) benefits, if the Secretary determines that the improvements meet specific criteria detailed in the authority. Additionally, Section 1202(c)(3) of WRDA 2016 “Additional Studies, Arctic Deep Draft Port Development Partnerships” allows for the consideration of transportation cost savings benefits to national security. The proposed port modifications intend to improve navigation efficiency to reduce the costs of commodities critical to the viability of communities in the region. This study has been cost-shared, with 50 % of the study funding provided by the non-Federal sponsor, which is the City of Nome, per the Federal Cost Share Agreement.

The Port of Nome is a regional hub port located on the Seward Peninsula and adjacent to the Norton Sound, which is centrally located along the Western Alaska coast. Nome has no access to the Alaska road system and is approximately 545 miles northwest of Anchorage, Alaska. Previous studies going back to at least 1997 by the United States Army Corps of Engineers (USACE) and others identify Nome as a major regional center of waterborne transportation and recommend improvements to the marine navigation system.

The purpose of this study is to identify a feasible solution that provides safe, reliable, and efficient navigation and mooring for vessels serving the hub community of Nome, Alaska. The project is needed to alleviate existing vessel restrictions that are imposed by insufficient channel depths and harbor area. Ship transportation into the Port of Nome, also referred to as the Nome Harbor, is presently limited by existing depths in the Outer Basin of minus 22 feet (ft) mean lower low water (MLLW). This basin depth is inadequate to safely accommodate vessels of drafts greater than approximately 18 ft Vessel traffic in the Arctic, coupled with limited marine infrastructure and available draft in Nome and the region, results in operational inefficiencies, vessel damages and decreased safety, increased costs of goods and services, and threats to the long-term viability of surrounding communities. A robust and efficient transportation hub at Nome is foundational to the long-term viability of communities in the region. As the United States’ only deep water port in the Arctic, Nome provides a critical link between these communities, the rest of Alaska, and beyond. Remote Alaska communities face challenges that are complex and multifaceted. The viability of a community is based on its ability to survive and thrive. Factors impacting community viability include (but are not limited to): economics, costs to add or replace critical infrastructure, risk of relocation, food security and access to resources for subsistence, and outmigration. While it is difficult to quantify a direct link between a Nome navigation project and improvements to the viability of a community, Port of Nome improvements can strengthen the resiliency of the region.

One aspect contributing to the viability of a community is the need to initially construct or replace aging or threatened critical infrastructure from the effects of climate change: thawing permafrost, rising sea levels, more frequent storms, and coastal erosion. Given a lack of infrastructure in some communities and inadequate systems in others, combined with challenges from climate change, the need for water and sewer improvements in the region is profound.

The viability of some villages in the region, and the safety and quality of life for the residents of those villages, is so threatened by climate change that they are considering relocation. The total rough order of magnitude cost for immediate relocation of two villages (Shaktoolik and Shishmaref) and phased relocation of an additional three villages (Teller, Golovin, and Unalakleet) totals over 1 billion dollars. The Port of Nome as a hub port for the region is in a position to support construction projects in the region by being a point of entry for construction goods that could be more efficiently delivered in larger volumes to Nome than the villages that lack a deep draft port. This could improve cargo reliability to the outlying villages as the large construction projects.

This draft Integrated Feasibility Report and Supplemental Environmental Assessment (IFREA) documents the analysis and coordination conducted to determine whether the Federal Government should participate in navigation improvements at Nome, Alaska that would ultimately provide benefits to the entire region identified as the Bering Strait Region lands, and determines the feasibility of Federal participation in potential improvements. This Supplemental EA is being released for public review. An IFREA document was previously released for public review in May 2019. Since that time, POA determined that changes in the project construction would cause effects to various endangered and protected marine mammal species. Specifically, the change in dock design from a concrete caisson to sheet pile dock causes higher noise impacts during construction than initially anticipated due to the pile-driving work now required.

Proposed modification to the Port of Nome improves navigation, provides safe, reliable, and efficient waterborne transportation systems for movement of commerce, national security, and recreation at the Port of Nome. The Port of Nome currently includes two basins, an Inner and Outer Basin. The Inner Basin is not part of this study. The study considers a wide range of measures and alternative plans, and the environmental consequences of those alternatives. Except for dredging and navigation aids, none of the non-structural measures were carried forward because they did not meet the planning objectives and criteria given site conditions, or they were already being considered or being implemented by the non-Federal sponsor at this time. Structural measures that were carried forward were combined to develop an initial array of alternatives evaluated, which were then screened to identify a final array of alternatives.

In addition to a "no action" plan (Alternative 1), 13 alternatives were initially evaluated. This initial array of alternatives was screened based on their ability to meet the project-specific objectives and performance criteria. Seven alternatives, including no action, were carried forward and evaluated with various dredge depths (Alternatives 1, 3a, 3b, 3c, 4a, 8a, and 8b). Dredged material management was evaluated as a separable element that did not influence plan selection because the same placement/disposal option and dredge method applied to all the alternatives. All of the structural alternatives generally included modifications that create a Deep Water Basin of varying sizes and depths at the entrance to the existing Outer Basin, increase the entrance channel width to the Outer Basin, and add docks for berthing.

Table ES-1. General description of modifications by alternative.

Alternative Number	Description of Modification[1]
1	No Action
3a, 3b, 3c	2,340 ft long L-Shaped West Causeway extension to approximately -30 ft MLLW and modification of the East Breakwater
4a	Similar to Alternative 3a-3c, except a portion of the East Breakwater is converted to a combination causeway/breakwater aligned along F Street
8a, 8b	3,937 ft (Alt. 8a) or 3,484 ft (Alt. 8b) West Causeway extension to approximately the -45 ft MLLW bathymetric contour (Alt 8a) or -40 ft MLLW (Alt 8b), removal of the East Breakwater, and construction of a new East Causeway aligned with F-Street

Note: (1) All the alternatives include additional docks, dredging to -28 ft MLLW in Outer Basin, dredging between -30 and -40 ft MLLW in the Deep Water Basin, and new utilities (fuel header, pipelines, water and electrical), except the No Action Alternative. Each alternative also includes a nearshore placement area for dredge material.

The measures or features that differentiated between the alternatives ranged from minimal changes to the existing east breakwater (Alternatives 3a, 3b, and 3c), converting a portion or all the east breakwater to a causeway (Alternative 4a), and varying the number of docks, to the most extensive modification of removing the east breakwater and replacing it with a causeway further to the east (Alternative 8a and 8b). Nearshore placement of the new work dredge material and beach placement of the future maintenance dredge material was selected for each alternative.

The significant design changes from the draft report released in May 2019 are: 1) the dock's design has changed from caissons to a sheet pile design, and; 2) for Alternative 8a and 8b the east causeway has been replaced with a combination causeway/breakwater rather than an all causeway design.

The alternatives carried forward were evaluated using multiple analyses to identify a tentatively selected plan (TSP) including:

- National Economic Development (NED) analysis without and with national security benefits
- Cost effectiveness/ incremental cost analysis (CE/ICA) for other social effects (OSE) (as part of the Section 2006 analysis) without national security benefits and with national security benefits (Section 6.5)

No alternative plan reasonably maximized benefits or resulted in a positive benefit-cost ratio (BCR), indicating that a plan could not be selected on the merits of the NED analysis with or without national security benefits. Although the BCRs improved after considering national security benefits, they were still below one so no NED plan was identified. National Security contributions of alternative plans were evaluated in terms of a unit referred to as National Security Units (NSUs). The national security benefits originated from United States Northern Command (NORTHCOM) and United States Coast Guard (USCG) fuel savings estimates that would result if fuel was obtained at the Port of Nome versus more southern ports.

No NED plan was identified, with or without national security benefits as presented in the table below in $1000s. Costs and benefits are shown at FY20 Price Levels and using the FY20 discount rate of 2.75 %.

Table ES-2. NED Analysis Summary for Plans also identified as Cost-Effective or Best Buys per the CE/ICA in $1000s.

Alt. & Depth	AAEQ Benefits w/o NS(1)	Benefits w/ NS	AAEQ Costs	Net Benefits w/o NS	Net Benefits w/ NS	BCRs(2)
3a 40(3)	$2,203	$12,873	$14,629	-$12,426	-$1,756	0.2/0.9
4a 40	$2,068	$12,738	$17,722	-$15,654	-$4,984	0.1/0.7
8a 40	$2,068	$12,738	$28,637	-$26,569	-$15,899	0.1/0.4
8b 40	$2,068	$12,738	$27,300	-$25,232	-$14,562	0.1/0.5

Notes: (1) NS = National Security also referred to as Government benefits in the Economic Appendix. (2) The first number before the back slash is the BCR without government (national security) benefits (Gov't) and the second is with government benefits. (3) The alternative designation includes the alternative number (3a) number and the reference to the Deep Water Basin depth (40 = -40 ft MLLW).

Without a NED plan, Section 2006 allows selection to be supported by a CE/ICA. For the CE/ICA, multiple OSE benefit categories important to community viability were developed. These categories were ranked as they related to each alternative plan with a qualitative scoring system, and then the scores were combined for each alternative to create a community viability unit (CVU) score. The CVU score and related cost for each plan were evaluated using the Institute of Water Resources (IWR)-Planning suite to identify the best buy plans of Alternatives 4a, and 8a, with 8b a cost-effective plan. For these plans the dredge depth for the Outer Basin is -28 ft MLLW plus 1 foot over dredge (-29 ft MLLW) and the Deep Water Basin is -40 ft MLLW plus 2 ft of over dredge (-42 ft MLLW).

For the purpose of the main alternatives evaluation, NSUs are considered separately from CVUs. The CE/ICA without national security benefits identified three Best Buy plans (No Action and Alternatives 4a and 8a), and two Cost Effective plans (Alternatives 3a and 8b). When considering national security Alternative 8a changed to Not Cost Effective and the formerly Cost Effective plans become Best Buy plans. The NED analysis and CE/ICA results for these four active plans are summarized in Table 31 and Table 32, respectively.

Table ES-3. CE/ICA Summary for Plans identified as Best Buy or Cost-Effective.

Alt.	Total Cost (in $1000s)	CVUs w/o NSUs(2)	CVUs w/ NSUs	Type w/o NSUs	Type w/ NSUs
3a 40(1)	$324,798	500	500	Cost Effective	Best Buy
4a 40	$386,900	875	1,775	Best Buy	Best Buy
8a 40	$644,935	1,000	2,000	Best Buy	Not Cost Effective
8b 40	$631,019	950	1,950	Cost Effective	Best Buy

Notes: (1) The alternative designation includes the alternative number (3a) number and the reference to the Deep Water Basin depth (40 = -40 ft MLLW). (2) NSUs = National Security Units also referred to as Government benefits in the Economic Appendix

Selection of the Tentatively Selected Plan (TSP) (Alternative 8b/the agency's preferred alternative) became more complicated without an identified NED plan, and the CE/ICA identifying several Best Buy and Cost Effective Plans. Alternative 8b was selected over Alternative 8a because the total project cost of the former is lower by approximately $13.9 M and both alternatives performed well in a navigation simulation. Alternative 8b was selected over Alternative 4a even with a higher total cost of approximately $244.1 M because of maneuverability and safety concerns expressed by the pilots that participated in the navigation simulation and as documented in the Alaska Marine Pilots LLC letter dated 26 August 2019 (see discussions in Section 6.2 and Appendix C, Section 4.2).

This pilot's letter expresses safety and maneuverability concerns associated with the smaller dimension plan (specifically Alternative 4a) and the pilot concerns over the utility of Alternative 4a operations, adequacy of the entrance channels and turning basins, and unsafe conditions during turns and docking. The pilots noted that Alternative 4a does not have adequate maneuvering room and every dock must be vacated of moored vessels when large vessels are accessing the Outer Basin. While the pilots were able to successfully navigate the Outer Basin of 4a with vessels at docks, these runs required precise maneuvers that would not have been attempted with actual vessels due to damage and safety risks. The pilots also noted that a very unsafe condition of full stopping power of assist tug and vessel astern power were required with no margin for error to stop the vessel in the Deep Water Basin of Alternative 4a, and if deceleration operations were initiated too late in the dock approach or stern winds increased, there would be no means to prevent the vessel from colliding with the structure.

The use of maximum assist tug power is considered a very unsafe condition, and the USACE would recommended that more powerful tugs than those used in the ship simulations (1700 horsepower [hp]) be used in the new harbor: however, the availability of tugs was not studied during this effort. Both the sponsor and the pilots indicated that it would be difficult to find and sustain tugs larger than the 1700 hp size at Nome due to vessel availability and the expected frequency of use. Pilot comments during the ship simulator suggested tolerable wind speeds for navigation through Alternative 4a would be 10 knots and wind speeds for 8B would be 20 knots. Based on the airport wind analysis, pilot wind speed requirements to navigate the harbor for 4a would be exceeded 36.3 % of the time during the open water season, whereas conditions to navigate 8B would be exceeded 2.6 % of the time.

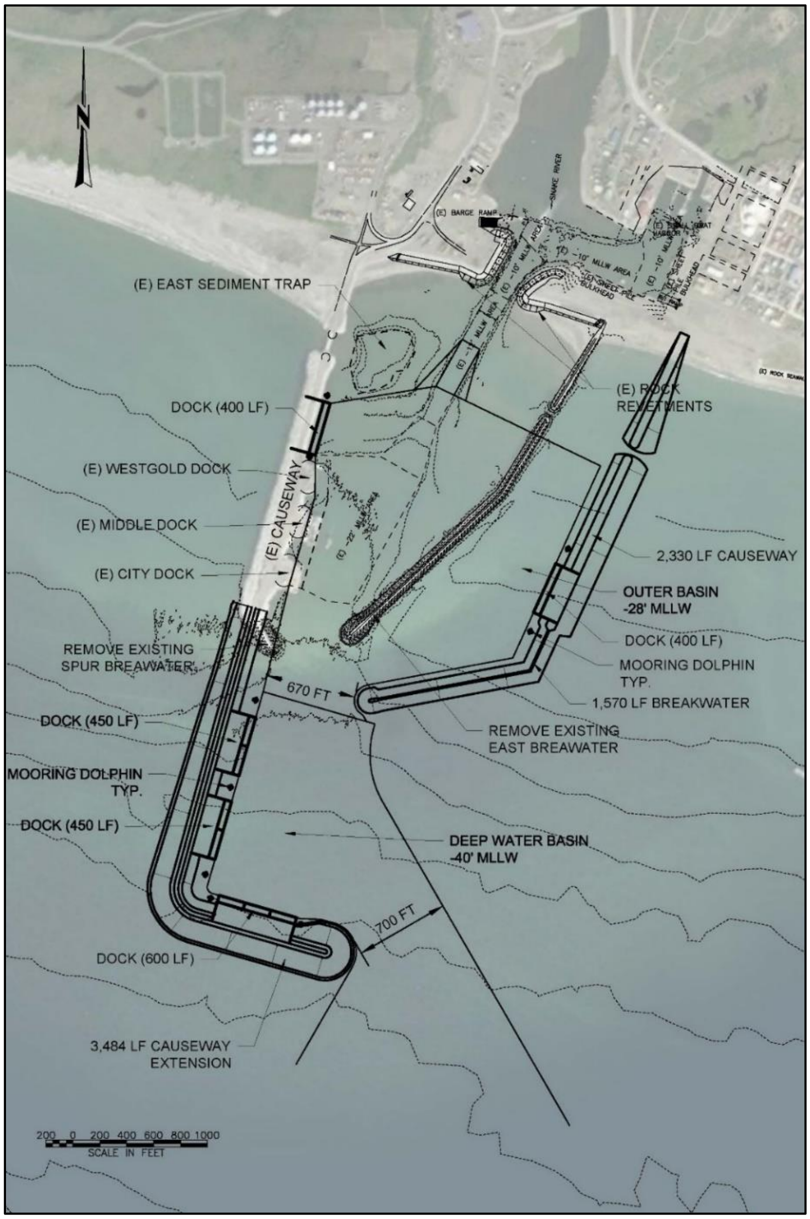

Figure ES-1. Tentatively Selected Plan (Alternative 8b)

The Outer Basin modifications include removing the existing breakwater spur from the south end of the existing West Causeway, extending this causeway to deep water, and increasing the entrance width to the Outer Basin. The existing east breakwater is removed with approximately 75% of the generated materials reused in the new project features (causeways and/or breakwaters). A new East Causeway/Breakwater combination, approximately aligned with F-Street extends to approximately -25 ft MLLW with a total length of 3,900 ft (2,400 ft causeway/1500 ft breakwater). The Outer Basin channel entrance width increases to approximately 670 ft, and 400 ft long docks are added to the West and East Causeways. The Outer Basin is deepened from -22 ft

MLLW to -28 ft MLLW. The maximum pay dredge depth in the Outer Basin is -29 ft MLLW.

The new Deep Water Basin is formed by extending the West Causeway by approximately 3,484 ft to a depth of -40 ft MLLW. This extension is “L” shaped with the north-south trending section 2,100 ft long and the west-east section 1,384 ft long. The “L” shaped opening faces east, which provides wave protection for the Deep Water basin during west and south winds. Two 450-foot and a 650-foot long dock are incorporated in the West Causeway extension. The Deep Water basin is deepened to -40 ft MLLW with a maximum pay dredge to -42 ft MLLW. A summary of the plan components are presented in Table 34 followed by additional narrative.

Mitigatory measures identified to date include the beneficial relocation and reuse of cobbles and boulders (potential juvenile crab habitat) that are recovered from the seafloor during project construction dredging, avoidance of marine mammals and protected species during construction activities, and minimization of impacts to significant cultural resources by having an archaeologist present during all land construction activities. The proposed new east causeway would also include a breach and bridge to allow for nearshore fish passage.

Remaining risks and uncertainties fall within the categories of study, implementation/construction, and operation, and are discussed in Section 6.8. The remaining study risks include an accelerated study schedule (high), and finalizing a Government-to-Government Memorandum of Agreement (MOA) with Federally-recognized tribes (low). Implementation risks of identifying an alternate sediment disposal site for the dredged material, a new breakwater alignment or change in dredge assumptions that could increase cost were categorized as low risk. Implementation risks regarding performing marine mammal surveys, developing an Incidental Harassment Authorization application, and coordinating in the development of a Biological Opinion during Preconstruction, Engineering and Design (PED) were characterized as low to medium, with the higher risk driven by potential weather delays of field work. Operation risks were also characterized as low risk and include a change to existing laws on benthic trawling and commercial fishing that could change the composition of vessels in the area, changes due to oil and gas development that could change vessel traffic in the Arctic, unanticipated sedimentation that would affect O&M, impacts of sea level change and uncertainty whether assumptions regarding shippers’ potential change in their own operations would materialize.

The specific economic risk for this project is the opportunity to realize uncertain transportation cost savings by making modifications to the port. This opportunity is triggered by the local sponsor’s desire for a larger port with deeper basins and more docks that can produce the cost savings benefit. The consequence of this opportunity being realized is a cost savings to western Alaska shippers and the Nation. In order for these cost savings benefits to be realized vessel traffic volumes must remain steady or increase over the foreseeable future, and modifications to the port need to allow enhanced maneuverability or delay reductions.

There is uncertainty whether shippers would shift to newer, or larger, or more fuel efficient vessels to move the existing commodities into and around Nome. If they do, this should lead to increases efficiencies, and take advantage of economies of scale available to them with the modified port. The benefits developed for this project do not rely on a significant increase in Oil and gas development in the arctic. This condition could change rapidly with future offshore oil and gas resource discoveries; which may significantly increase benefits and cost savings. The risk identified in the paragraph above is part of an uncertainty in the assumption made for this report in that the larger fuel vessels would change their current behavior and prefer to off-load fuel in the port, rather than anchor off-shore and lighter fuel or act as “floating gas stations” for the smaller fuel barges that deliver fuel to outlying communities in the region.

Project cost sharing of the general navigation features is based on “Project First Cost.” Project First Cost is the monetary outlay of constructing the project, brought to the effective price level (Fiscal Year 2020) and does not include inflation. This financial cost is different than an economic cost used in BCRs for alternative selection. Economic costs include all of the opportunity costs, both explicit (Operation, Maintenance, Repair, Replacement, and Rehabilitation (OMRRR), local service facilities (LSF), and associated costs) and implicit interest during construction (IDC) of using the resource. The project cost breakdown for Alternative 8b are presented in the Pertinent Data Tables below.

PERTINENT DATA

Tentatively Selected Plan: Alternative 8b
Project Components

- Demolition of Existing West Causeway Spur and all of the East Breakwater
- Extend West Causeway ("L" Shaped) to Create Deep Water Basin
- Construct New East Causeway/Breakwater combination
- Add Docks (sheet pile supported) to West Causeway and East Causeway
- Add Moorage Dolphins (pile driven) to all new docks
- New Work Dredging
- Annual Maintenance Dredging

Feature	Units	Approximate Quantity
General Navigation Funded Work Items		
Demo Spur/Breakwater/400 ft of existing Breakwater:		
A1- Rock Removal	CY	32,574
A5- Rock Removal	CY	69,354
B2- Rock Removal	CY	25,940
B3 - Rock Removal	CY	17,674
Core and Quarry Spall Removal	CY	106,540
Total Rock Removed for reuse	CY	243,671
West Causeway Extension		
Length	LF	3,484
Dredge for Causeway BW Armor toe	CY	807,633
A1 Rock (A22)	CY	245,732
Reuse A1 Rock (1)	CY	24,430
A5 Rock	CY	359
Reuse A5 Rock (1)	CY	52,016
B2 Rock	CY	136,291
Reuse B2 Rock (1)	CY	19,455
B3 Rock (B22 Rock)	CY	11,488
Reuse B3 Rock (1)	CY	13,256
C1 Rock (C8 Rock)	CY	47,310
C2 Rock	CY	15,884
D Fill	CY	87,191
E Fill	CY	1,120,426
F Fill	CY	105,188
D1 Surface Course	CY	6,684
Relocate Rock for Re-use (A & B Rock)	CY	109,156
Note: (1) Assumed 75 % of demolition rock available for reuse		
East Breakwater/Causeway		
Length	LF	3,900
Dredge for Causeway BW Armor toe	CY	65,255
A1 Rock (A22)	CY	26,932
A5 Rock	CY	113,901
B2 Rock (	CY	20,174
B3 Rock (B22 Rock)	CY	54,330
C1 Rock (C8 Rock)	CY	3,250

C2 Rock	CY	35,575
Filter Rock (D8)	CY	34,363
D Fill	CY	32,046
E Fill	CY	65,255
F Fill	CY	60,985
D1 Surface Course	CY	3,056
West Causeway 400 Foot Dock		
Length	LF	400
E Fill	CY	118,948
F Fill	CY	29,468
D1 Surface Course	CY	1,985
New Work Dredge Quantities and Areas		
Outer Basin – Dredge to -29 ft MLLW Max Pay Depth	CY	2,015,800
	Acres	88
Deep Water Basin - Dredge to -42 ft MLLW Max Pay Depth	CY	517,600
	Acres	55
Nearshore Placement Area (i.e., Depth of Closure)	CY (total)	2,533,400
	LF	~6,000
	LF	~1,800
	Acres	241
	Minimum Depth	-15 ft MLLW
	Maximum Depth	-30 ft MLLW
	Maximum Height	-15 ft MLLW
Annual Maintenance Dredge Quantities and Areas		
Outer Basin – Annual Dredge to -29 ft MLLW Max Pay Line	CY	88,000
	Acres	24
Deep Water Basin – Annual Dredge to -42 ft MLLW Max Pay Line	CY	16,000
	Acres	55
Hydraulic Placement of Slurry on Beach	CY (total)	104,000
	Point discharge near east end of City sea wall	

Economics

Economics (in 1000s) Alternative 8b with Deep Water Basin Dredged to -40 Ft MLLW	
Average Annual Equivalent Benefits	$2,068
Average Annual Equivalent Costs	$27,300
Benefit-Cost Ratio	0.1
Benefit Cost Ratio (with national security benefits)	0.5

* These numbers are preliminary and will be updated with the final version of this report.

The project cost breakdown for Alternative 8b with the Deep Water Basin dredge to -40 ft MLLW (-42 ft MLLW Max Pay Line) and the Outer Basin to -28 ft MLLW (-29 ft MLLW Max Pay Line):

Description	Total	Federal	Non-Federal
General Navigation Features (deeper than -20FT but less than -50FT MLLW)	$491,108,000	$368,331,000	$122,777,000
LERR	$18,200		$18,200
Project Cost Apportionment	$491,126,200	$368,331,000	$122,795,200
10% over time adjustment (less LERR)*		($49,112,620)	$49,112,620
Final Allocation of Project First Costs	$491,116,200	$319,218,380	$171,907,820
Aids to Navigation (ATONS)	$85,000	$85,000	
Local Service Facilities			$119,693,000
Non-Federal Total Costs			$291,600,820
*10% over time adjustment ($491,126,200 GNF x 10% = $49,112,620 - $0 = $49,112,620)			

Note: Costs in this table are at the FY20 price levels and discount rate of 2.750. Cost sharing estimates are not based on certified cost until after the recommended plan costs are certified.

Cost effectiveness/ incremental cost analysis (CE/ICA) for other social effects (OSE) without national security benefits and with national security benefits are summarized below:

Alt.	Total Cost (in $1000s)	CVUs w/o NSUs	CVUs w/ NSUs	Type w/o NSUs	Type w/ NSUs
8b 40	$631,019	950	1,950	Cost Effective	Best Buy

Notes: The alternative designation includes the alternative number (3a) number and the reference to the Deep Water Basin depth (40 = -40 ft MLLW). NS = National Security also referred to as Government benefits in the Economic Appendix

LIST OF ACRONYMS

ADCRA	Alaska Division of Community and Regional Affairs
ADEC	Alaska Department of Environmental Conservation
ADFG	Alaska Department of Fish and Game
ADOT&PF	Alaska Department of Transportation and Public Facilities
ANCSA	Alaska Native Claims Settlement Act
AKDOL&WD	Alaska Department of Labor and Workforce Development
AFSC	Alaska Fisheries Science Center
ATS	Alaska Townsite Survey
AWC	Anadromous Waters Catalog
AVEC	Alaska Village Electrical Cooperative
BCR	Benefit-Cost Ratio
BMP	Best Management Practices
Borough	Northwest Arctic Borough
BSNC	Bering Strait Native Corporation
C	Celsius
C-MAN	Coastal Marine Automated Network
CAA	Clean Air Act
CE/ICA	Cost Effectiveness/Incremental Cost Analysis
CEQ	Council on Environmental Quality
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CFEC	Commercial Fisheries Entry Commission
CFR	Code of Federal Regulations
CG-L	U.S. Coast Guard Logistics
COL	Colonel
CWA	Clean Water Act
CY	Cubic Yards
DPS	Distinct Population Segment
EFH	Essential Fish Habitat
EA	Environmental Assessment
EIS	Environmental Impact Statement
EPA	Environmental Protection Agency
ER	Engineer Regulations
ESA	Endangered Species Act
etc.	Et Cetera
EQ	Environmental Quality
FAA	Federal Aviation Administration
F	Fahrenheit
FC	Full Compliance
FCSA	Federal Cost Share Agreement
FHWA	Federal Highway Administration
FMP	Fishery Management Plan

FONSI	Finding of No Significant Impact
FR/EA	Feasibility Report and Environmental Assessment
FWCA	Fish and Wildlife Coordination Act
FWP	Future With Project
ft	Feet/foot
GMSL	Global Mean Sea Level
GNF	General Navigation Feature
HTRW	Hazardous, Toxic, and Radioactive Wastes
IDC	Interest During Construction
IFREA	Integrated Feasibility Report and Environmental Assessment
ISER	Institute of Social and Economic Research
JPL	Jet Propulsion Laboratory
kg	Kilograms
lbs	Pounds
LERR	Lands, Easements, Real Estate, and Rights-Of-Way
LPP	Locally Preferred Plan
LSF	Local Service Facilities
mg	Milligrams
MBTA	Migratory Bird Treaty Act
MHHW	Mean Higher High Water
MHW	Mean High Water
MLLW	Mean Lower Low Water
MLW	Mean Low Water
MMPA	Marine Mammal Protection Act
MSL	Mean Sea Level
MTL	Mean Tide Level
N/A	Not Applicable
NAAQS	National Ambient Air Quality Standards
NASA	National Aeronautics and Space Administration
NED	National Economic Development
NEPA	National Environmental Policy Act
NHPA	National Historic Preservation Act
NMFS	National Marine Fisheries Service
NOAA	National Oceanic and Atmospheric Administration
O&M	Operation and Maintenance
OCT	Opportunity Cost of Time
OMB	Office of Management and Budget
OMRRR	Operation, Maintenance, Repair, Replacement, and Rehabilitation
OSE	Other Social Effects
PC	Partial Compliance
PDT	Project Delivery Team

PED	Preconstruction Engineering and Design
PSMSL	Permanent Service for Mean Sea Level
R	Republican
RED	Regional Economic Development
S&A	Supervision and Administration
SHPO	State Historic Preservation Officer
SIOH	Supervision, Inspection, and Overhead
TSP	Tentatively Selected Plan
U.S.	United States
UDV	Unit Day Value
USACE	U.S. Army Corps of Engineers
U.S.C.	United States Code
USCG	United States Coast Guard
USDA	United States Department of Agriculture
USEPA	United States Environmental Protection Agency
USFWS	United States Fish and Wildlife Service
USGS	United States Geological Survey
USN-L	U.S. Navy Logistics
USS	United States Survey
VLM	Vertical Land Movement
VPO	Village Public Safety Officer

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1.0 INTRODUCTION

1.1 Authority

This feasibility study is being conducted under the authority granted by Section 204 of the Flood Control Act of 1948, which authorizes a study of the feasibility for development of navigation improvements in various harbors and rivers in Alaska. Section 204, as amended by the Flood Control act of 1950, states:

> "*The Secretary of the Army is hereby authorized and directed to cause preliminary examinations and surveys for flood controls and allied purposes… to be made under the direction of the Chief of Engineers, in drainage areas of the United States and Territorial possessions, which include the following named localities:… Harbors and Rivers in Alaska, with a view to determining the advisability of improvements in the interest of navigation, flood control, hydroelectric power, and related water uses."*

In 1970, the House of Representatives passed a resolution authorizing a review of:

> "*the reports of the Chief of Engineers on Rivers and Harbors in Alaska, published as House Document Numbered 414, 83rd Congress, 2nd Session* [and]*… Northwestern Alaska* [including Nome]*, published as House Document Numbered 99, 86th Congress, 1st Session; …, with a view to determining whether any modifications of the recommendations contained therein are advisable at the present time.*"

The study is also using the authority of Section 2006, Remote and Subsistence Harbors, of the Water Resources Development Act of 2007 (WRDA 2007, P.L. 110-114), as modified by Section 2104 of the Water Resources Reform and Development Act of 2014 (WRRDA 2014) and further modified by Section 1105 of the Water Infrastructure Improvements for the Nation Act of 2016 (WRDA 2016, P.L. 114-322). The authority states that in conducting a study of harbor and navigation improvements the Secretary may recommend a project without demonstrating that the improvements are justified solely by National Economic Development (NED) benefits if the Secretary determines that the improvements meet specific criteria as quoted [bullets list criterion's applicability to the current study]:

(1) (A) *[t]he community to be served by the improvements is at least 70 miles from the nearest surface accessible commercial port. It has no direct rail or highway link to another community served by a surface accessible port or harbor, or (B) the improvements would be located in the State of Hawaii or Alaska, the Commonwealth of Puerto Rico, Guam, the Commonwealth of the Northern Mariana Islands, the United States Virgin Islands; or American Samoa* [33 U.S.C. § 2242(a)(1)(A)&(B)];

- The project would be located in the State of Alaska

(2) *[t]he harbor is economically critical such that over 80 percent of the goods transported through the harbor would be consumed within the region served by the harbor and navigation improvement as determined by the Secretary, including consideration of information provided by the non-Federal interest; and* [33 U.S.C. § 2242(a)(2)]

- Waterborne commerce statistics validate that 80 percent of goods are transported and consumed within the region, including fuel/petroleum, gravel, goods, and commodities

(3) *[t]he long-term viability of the community in which the project is located, or the long-term viability of a community that is located in the region that is served by the project and that will rely on the project, would be threatened without the harbor and navigation improvement* [33 U.S.C. § 2242(a)(3)].

- Many of the villages Nome services are legitimately threatened due to the high prices of fuel and goods; see Section 2.10 for additional discussion on viability

Per Section 2006 of WRDA 2007 as amended by Section 2104 of WRRDA 2014, while determining whether to recommend a project under the criteria above, the Secretary will consider the benefits of the project to these resources:

(1) public health and safety of the local community and communities that are located in the region to be served by the project and that will rely on the project, including access to facilities designed to protect public health and safety;

(2) access to natural resources for subsistence purposes;

(3) local and regional economic opportunities;

(4) welfare of the regional population to be served by the project; and

(5) social and cultural value to the local community and communities that are located in the region to be served by the project, and that will rely on the project [33 U.S.C. § 2242(b)].

- These considerations are discussed in Section 2.10 on viability and within the CE/ICA and Community Viability Unit.

1.1.1 Additional Study Guidelines

Additionally, Section 1202(c)(3) of WRDA 2016 "Additional Studies, Arctic Deep Draft Port Development Partnerships," allows for the consideration of national security benefits.. Section 1202(c)(3) of WRDA 2016 also expands the feasibility justification of an arctic deep-draft harbor and related navigation improvements to include:

e) CONSIDERATION OF NATIONAL SECURITY INTERESTS.—In carrying out a study of the feasibility of an Arctic deep draft port, the Secretary—

> *(1) shall consult with the Secretary of the department in which the Coast Guard is operating to identify benefits in carrying out the missions specified in Section888 of the Homeland Security Act of 2002 (6 U.S.C. 468) associated with an Arctic deep draft port;*
>
> *(2) shall consult with the Secretary of Defense to identify national security benefits associated with an Arctic deep draft port; and*
>
> *(3) may consider such benefits in determining whether an Arctic deep draft port is feasible*

1.2 Non-Federal Sponsor

The City of Nome is the non-Federal sponsor for this study. The Federal Cost Share Agreement (FCSA) was signed on February 02, 2018. This study, as requested by the City of Nome, will undertake the activities and tasks needed to identify and evaluate alternatives and will result in the preparation of a decision document that, as appropriate, recommends a coordinated and implementable solution for navigation improvements at the Port of Nome, Alaska.

1.3 Scope of Study

This study examines the feasibility and potential environmental effects of proposed navigation improvement alternative plans at the existing Port of Nome. The study will result in an Integrated Feasibility Report and Environmental Assessment (FR/EA), which evaluates alternative plans based on economic, engineering, environmental, and cultural resource factors, and considers national security benefits under the various authorities and guidelines referenced previously in Chapter 1.0. Under the Section 204 Authority, the alternative plans will be evaluated for Federal interest based on NED benefits; however, the Section 2006, authority allows for selection of a project without demonstrating that the improvements are justified solely by NED benefits. Per the Implementation Guidance for Section 2006, plan selection can be based on a cost effectiveness/ incremental cost analysis (CE/ICA) in the Other Social Effects account. Also, Section 1202(c)(3) of WRDA 2016 allows for the consideration of national security benefits, although plan selection cannot be solely based on these benefits, but it does allow them to be considered during plan selection.

1.4 Study Area

The Port of Nome is a regional port located on the Seward Peninsula and adjacent to the Norton Sound, which is centrally located along the Western Alaska coast (Figure 1). Nome has no access to the Alaska road system and is approximately 545 miles northwest of Anchorage, Alaska.

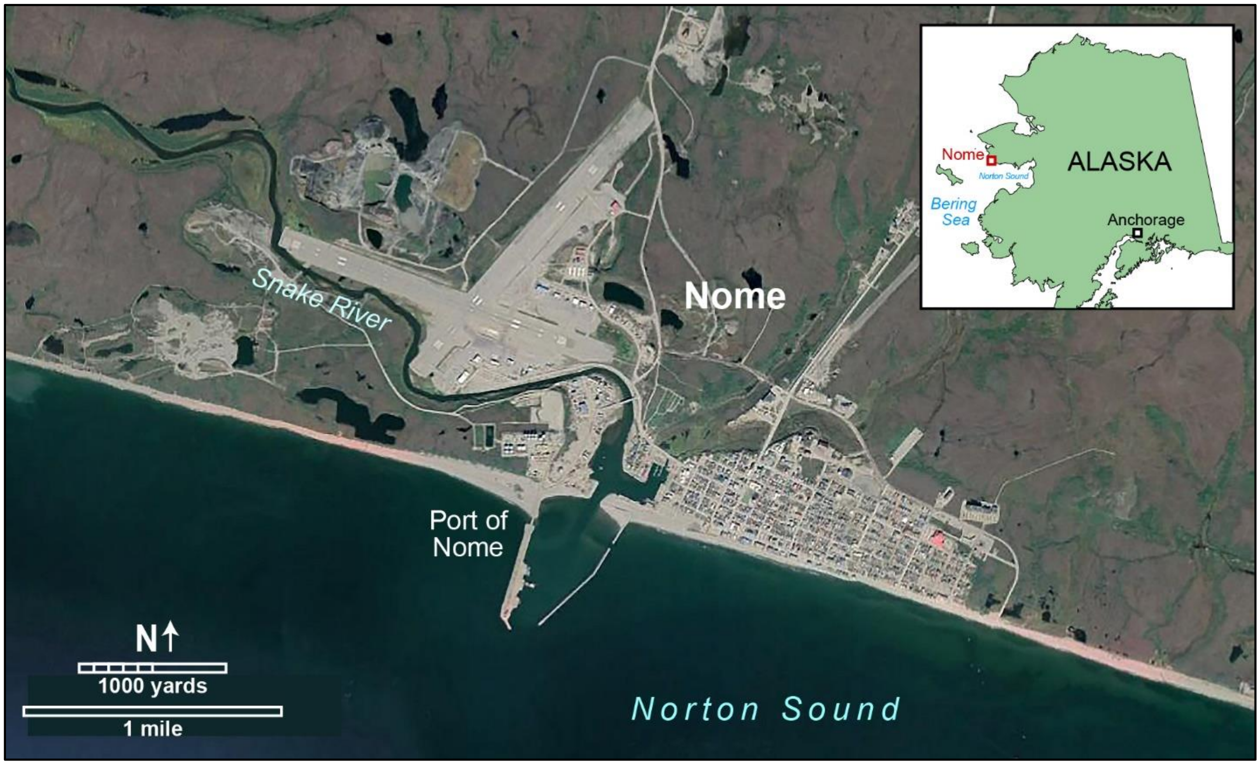

Figure 1. Vicinity Map

The study area for this project is generally defined as the area within which significant project impacts occur with the origins and destinations of products likely to use the waterway or port. This description of the study area may mean different things to the various disciplines involved in the study. For example, environmental and cultural professionals may consider a more focused area during the study, when compared to the economic analysis, because project environmental/cultural impacts may be more localized.

A previous port study United States Army Corps of Engineers (USACE 2016) reported that Nome was a hub city for 50 communities in western and northern Alaska. For the current project, the study area is defined as the lands of the Bering Straits Native Corporation (BSNC), a for-profit corporation formed in 1972 as the Alaska Native Claims Settlement Act regional native corporation for the Bering Strait Region. The BSNC controls approximately 2.1 million acres (3,282 square miles [sq mi]), which is larger than the State of Delaware (2,489 sq mi), and includes lands adjacent to Norton

Sound and the Seward Peninsula as well as St. Lawrence Island, King Island, and Little Diomede Island. Kawerak, Inc., is the regional non-profit native corporation that provides services throughout the Bering Strait Region (Figure 2).

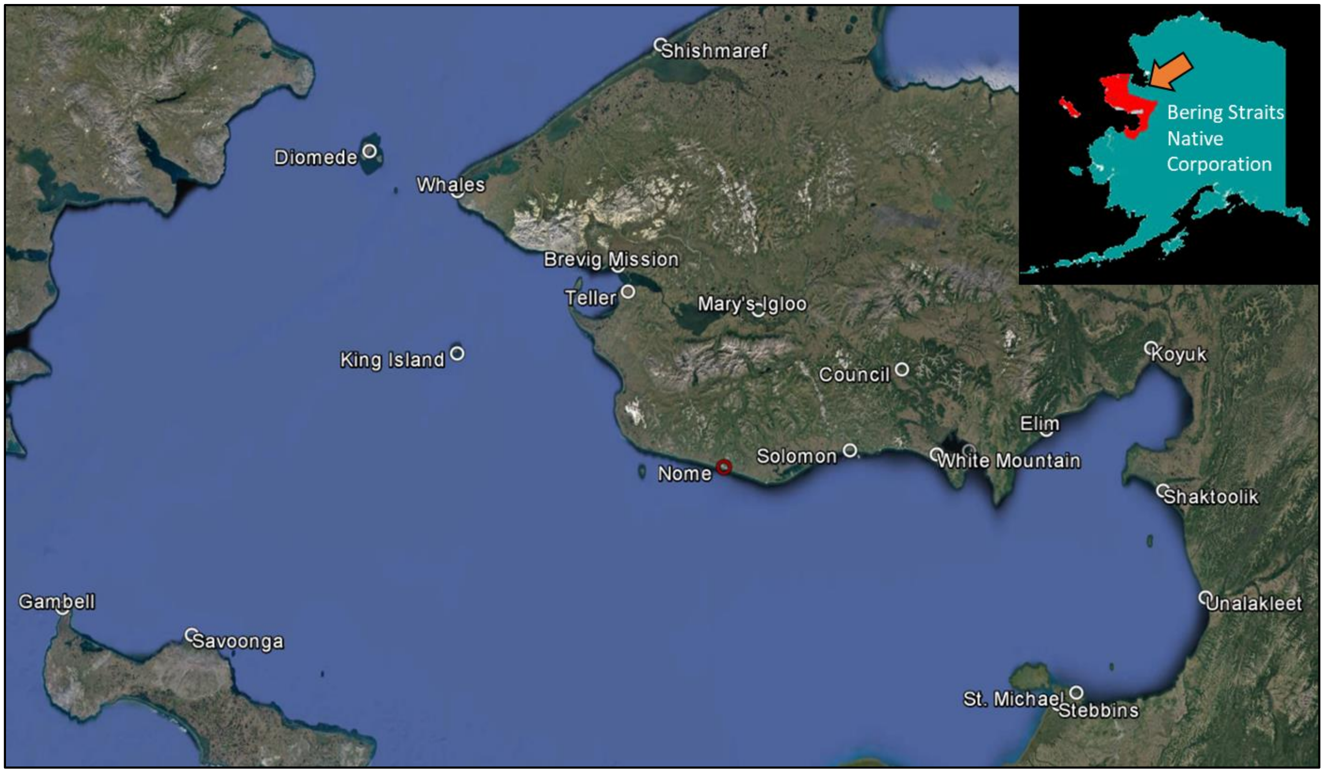

Figure 2. Study Area within the Bering Strait Region

The BSNC region includes 20 federally-recognized tribes and 20 village corporations. There are 18 incorporated year-round communities (Brevig Mission, Council, Elim, Gambell, Golovin, Inalik, King Island, Koyuk, Nome, Savoonga, Shaktoolik, Shishmaref, St. Michael, Stebbins, Teller, Unalakleet, Wales, and White Mountain) and two unincorporated communities, Port Clarence and Solomon (see Figure 2). Most residents from King Island now live in Nome. In addition, the community of Mary's Igloo is occupied seasonally.

Of the 18 year-round villages within the BSNC region, 11 (Brevig Mission, Elim, Gambell, Koyuk, Savoonga, Shaktoolik, Shishmaref, Stebbins, Teller, Wales, and White Mountain) are listed as a distressed community in the 2018 Distressed Communities Report dated June 2018 and prepared by the Denali Commission, an independent federal agency designed to provide critical utilities, infrastructure, and economic support throughout Alaska (Denali 2018).

The communities in the BSNC substantially depend on wild foods for nutrition and other customary and traditional uses. Hunting, fishing, and plant gathering are critical activities to the people of the region to participate in the subsistence lifestyle that is typically required to survive in remote regions of Alaska. The cash/commercial sector is also critical to the subsistence lifestyle in that it generates income from jobs or other sources that are used to invest in equipment and fuel to harvest wild foods. Individuals and family groups depend on this mixed, subsistence-cash/commercial economy in these rural communities, including Nome. Small and larger-scale seasonal commercial fishing is an example of one commercial sector activity that generates income that affords individuals and/or other members of the family group the resources to participate in the harvest of wild foods. Production of Native crafts, which can include carvings, jewelry, baskets, qiviut (clothing made from gathered inner wool that sheds each spring from the musk ox), and other types of native art, also provides some income for individuals or family groups A single website (Maruskiya's of Nome) listed over 112 artists from Nome and the surrounding region.

1.5 Project Site Location

The proposed project site (i.e., Port of Nome, also referred to as the Nome Harbor) is located in proximity to mining operations, offshore petroleum operations, shipping lanes, and communities in the BSNC region. The local road network is confined to the Seward Peninsula, with no road access to greater Alaska. Nome is a regional center for retail services, transportation, mining, medical, native art, and other businesses for the BSNC region, and beyond, including the western and northern coastlands of Alaska. The Nome Airport is a state-owned, public-use airport approximately 2 miles west of the business district of Nome and the Port of Nome.

The Port of Nome includes two general areas, typically referred to as the Inner and Outer Basins (Figure 3). The Snake River flows into the northwest corner of the Inner Basin and exits into the Outer Basin in the southwest corner. The Inner Basin is not part of this study and improvements to the Inner Basin are being studied under the Continuing Authority Program (CAP) (Section 107).

The Port of Nome has limited refuge capacity, especially for the larger vessels, due to the relatively shallow basins, limited berthing, and open area within the basins suitable for anchorage. The Outer Basin is protected by the existing west causeway and the east breakwater, and it includes a federally maintained navigation channel and turning basin (Figure 3). The Outer Basin has a natural entrance channel depth of approximately minus (-) 26 feet (ft) mean lower low water (MLLW), and relatively favorable distances to naturally deep water, as discussed later in this report in Section 3.1.4. The USACE typically performs annual maintenance dredging within the federal limits with specific locations determined each year based on need. The depths maintained within the federal limits range from -12 to -22 ft MLLW. A sediment trap is located within the Outer

Basin, east of the causeway bridge, to capture sediments carried by the longshore currents from the west.

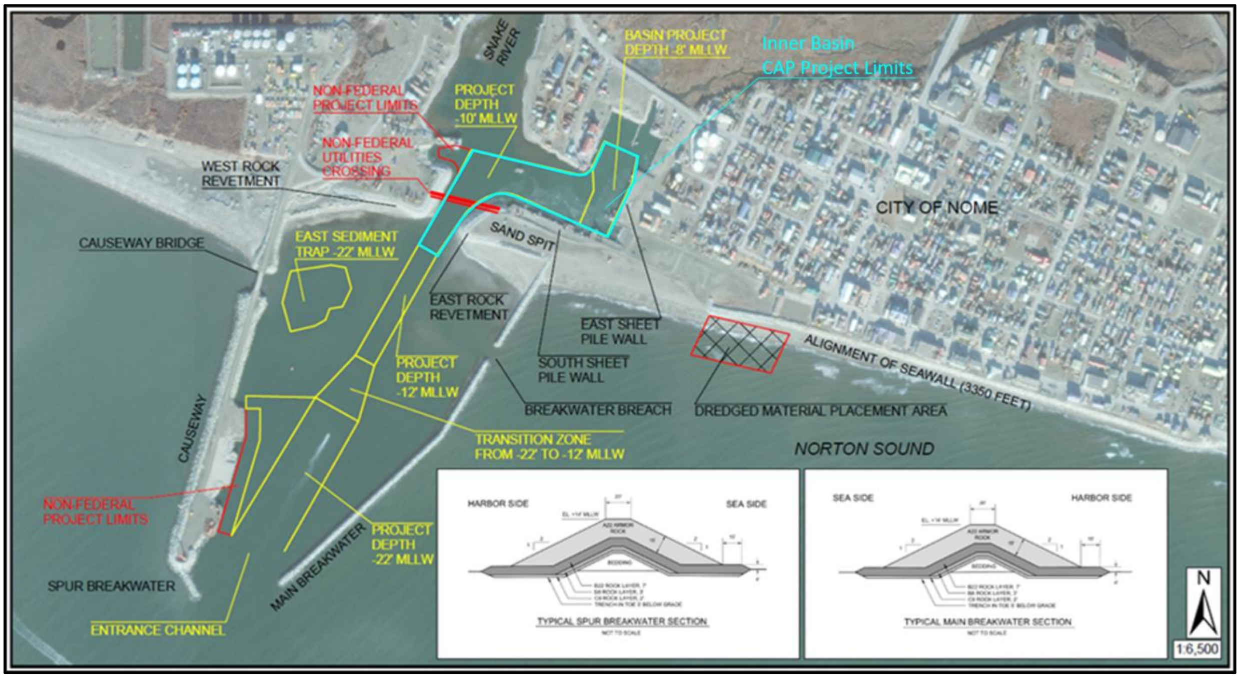

Figure 3. Port of Nome General Features

1.6 Congressional Delegation

The study area lies wholly within the State of Alaska, with the Congressional delegation of Senator Lisa Murkowski (R), Senator Dan Sullivan (R), and Representative Don Young (R).

1.7 Related Reports and Studies

The Nome Federal navigation project was first authorized by the Rivers and Harbor Act of August 8, 1917. The authorization was used to construct jetties, dredge a channel, and armor the banks of the Snake River with a stone revetment. The first project was completed in 1923. Subsequent construction leading to the current port features, including modification of the original jetties, construction of a seawall along the Nome shoreline, construction of a rubble mound causeway into Norton Sound, construction of sheet pile docks on the causeway, construction of a breakwater adjacent to the causeway, and re-alignment of the Snake River.

This GI study is evaluating measures in the existing Outer Harbor to allow larger vessels to utilize the port and alleviate harbor traffic for those larger recreational and industrial vessels. A CAP study is also in progress that was approved for funding in Fiscal Year 2019 (FY19). This CAP study is evaluating measures in the existing Inner Harbor to alleviate congestion for smaller vessels, including subsistence users. This CAP project is not being developed as a building block or in a sequence in an effort to avoid what should be analyzed as a larger scale project. The two projects are under separate study authorities. A memorandum (USACE 2019a) was approved by the Major Subordinate Command (MSC) on 12 December 2019 which designates the Inner Harbor CAP (Section 107) study as a separable element from the GI study. Expanding the Inner Harbor Federal dredging limits is not replicating a project specifically authorized by Congress, but rather assessing the feasibility of increasing the Federal limits through the CAP program. Additionally, benefits derived from expanding the Federal dredging limit would not be significant enough to influence the GI study plan selection decision.

This integrated draft document includes a supplemental EA because it is being released for a second public review. The first IFREA document was previously released for public review in May 2019 (USACE 2019b). However, since that time, the effects determination for various endangered and protected marine mammal species has changed from minor to major, making a second release for review necessary. The determination was changed because of a dock design adjustment from a concrete caisson to a sheet pile design. The sheet pile design causes higher noise impacts during construction than initially anticipated due to the pile driving work now required to install the docks. The public will have 30 days to review this IFR/Supplemental EA.

In the May 2019 draft IFREA the Tentatively Selected Plan (TSP) was identified on the merits of NED analysis with a positive benefit-cost ratio (BCR). Re-evaluation of the economic analysis and costs since May 2019 resulted no NED plan being identified. As a result, the CE/ICA was updated used to support plan selection.

A more detailed discussion of the existing facility construction history is presented in Appendix C (Hydraulic Design), Chapter 2.0. Recent related reports and completed studies are listed below:

USACE 1996. Navigation Improvement Reconnaissance Report Nome Alaska, 1996 Reconnaissance Study of the Port of Nome

USACE 1997. Reconnaissance of Navigation Improvements – Western and Arctic Coasts, Alaska – December 1997. This study investigated the present state of waterborne commerce in the area and probable future conditions. Five ports were identified as major regional centers of waterborne transportation: Unalaska/Dutch Harbor, Naknek, Dillingham, Bethel, and Nome.

USACE. 1998. Navigation Improvements Final Interim Feasibility Report and Environmental Assessment. Nome, Alaska. July 1998. This study recommended a plan for improvements to the marine navigation system at Nome, Alaska, which would reduce vessel delays, reduce damage to vessels due to grounding and hazardous entrance conditions, and ultimately increase vessel traffic and harbor use.

USACE. 2012. Environmental Assessment and Finding of No Significant Impact, Maintenance Dredging Nome Harbor Entrance Channel Environmental Assessment, Nome, Alaska, October 2012. This Environmental Assessment (EA) covers a 10-year maintenance dredging period, which proposes dredging 50,000 cubic yards initially in 2013 and 34,000 cubic yards each subsequent year.

USACE. 2015a. Supplemental Environmental Assessment and Finding of No Significant Impact, Maintenance Dredging Nome Harbor Entrance Channel Environmental Assessment, Nome, Alaska, March 2015. The USACE to propose the dredging of an additional 275,500 cubic yards to accomplish the required maintenance dredging initially described in the previous EA.

USACE 2016b. Draft Integrated Feasibility Report, Draft Environmental Assessment, and Draft Finding of No Significant Impact, Alaska Deep-Draft Arctic Port System Study, Alaska District, Pacific Ocean Division, November 2015. The USACE and the State of Alaska established the foundation for this study in 2008 and 2010 and built on the good work of others such as the Northern Waters Task Force, the Arctic Marine Shipping Assessment, and workshops with the Institute of the North. This study presents opportunities for the development of marine infrastructure in the Arctic by Federal, State, local, and/or private sector. A final report was not released.

2.0 PLANNING CRITERIA, PURPOSE & NEED FOR PROPOSED ACTION*

2.1 Problem Statement

The following draft problem statement was developed by the USACE and the non-Federal sponsor and was accepted at the 2-day charette in Nome in April 2018:

> *Vessel traffic in the Arctic, coupled with limited marine infrastructure and available draft in Nome and the region, results in operational inefficiencies, vessel damages and decreased safety, increased costs of goods and services, and threats to the long-term viability of surrounding communities.*

The existing port facilities in the region are overcrowded and have insufficient draft to accommodate new, deeper drafting vessel traffic. The Port of Nome is overcrowded due to a large number directly attributed to the number of barges and ships attempting to use the existing dock space. Large vessels delivering fuel and cargo to Nome for transshipment to other vessels for delivery to surrounding villages are often forced to anchor offshore or lighter goods to the port. The number of large vessels anchoring outside of the Port of Nome to lighter fuel and goods has been increasing significantly over the past 4 to 5 years according to the City of Nome (Joy Baker, personal communication, Port of Nome Director, 2018; United States Coast Guard (USCG), 2018) while at the charette. Commercial fishing vessels also add to the demand for space and services during the rush of activity that occurs during the short open water season. In addition, the existing harbor provides moorage and limited winter shelter for vessels.

Due to a lack of available draft along the western and northern coasts, USCG activity is limited to small vessels and helicopters, with the nearest USCG station to Nome about 800 miles away on Kodiak Island. However, because of long sailing times through remote and often rough waters, safety and security concerns are paramount for vessels traveling through the study area. In addition, a large percentage of vessels working in the Arctic that travel through the region are oil and gas transport vessels. There are limited facilities and potentially supplies available to support clean-up activities, should a spill occur at sea, or at the coastal communities during fuel transfer. Currently, if a critical need for supplies arises, the USCG uses the Port of Nome to lighter goods to their deep-draft vessels. Spill response vessels with a draft requirement greater than 22 ft would need to do the same. These limitations could lead to unacceptably long response times to calls for assistance.

2.2 Purpose and Need

The purpose of this study is to identify a feasible solution that provides safe, reliable, and efficient navigation and mooring for vessels serving the hub community of Nome, Alaska. The project is needed to alleviate existing vessel restrictions that are imposed by insufficient channel depths and harbor area. Ship transportation into the Port of Nome is presently limited by depth, with existing depths inadequate to safely accommodate vessels with drafts exceeding -18 ft MLLW, which allows for a 2 to 3 ft under keel clearance and a 1.5 ft tide fluctuation.

Vessel traffic in the Arctic, coupled with limited marine infrastructure and available draft in Nome and the region, results in operational inefficiencies, vessel damages and decreased safety, increased costs of goods and services, and threats to the long-term viability of surrounding communities. A robust and efficient transportation hub at Nome is foundational to the long-term viability of communities in the region.

2.3 Opportunities

Potential opportunities to be realized by improving navigation to/from the Port of Nome include:

- Improve long-term economic growth and stability in Nome
- Improve navigation access to community
- Increase investment in infrastructure
- Decrease economic damages
- Reduce life safety risk

- Improve system reliability
- Separate industrial and pedestrian traffic at the port for safety
- Support development of upland facilities

2.4 National Objectives

The Federal objective of water and land resources planning is to contribute to NED in a manner consistent with protecting the Nation's environment. NED features increase the net value of goods and services provided to the economy of the United States as a whole. Only benefits contributing to NED may be claimed for Federal economic justification of a project. For the purposes of this study, NED features may include breakwaters, channels, basins, float systems, and uplands.

Water resource planning must be consistent with NED objectives and must consider engineering, economic, environmental, and social factors. The following sections describe objectives are guidelines for developing alternative plans and are used to evaluate those plans.

2.5 Study Objectives

Study-specific objectives were identified during the planning charette. These objectives have been vetted through the vertical team in order to provide a clear path for the study.

At this time, the objective of the study is to recommend a project that provides safe, reliable, and efficient waterborne transportation systems for the movement of commerce, national security, and recreation at the Port of Nome. The proposed project objectives are:

- Reduce draft limitations to increase fuel transport capabilities and efficiency to satisfy fuel demand and reduce transportation cost
- Reducing draft limitations to better support multiple maritime missions: cargo transportation, search and rescue, emergency and oil spill response, natural resource exploration
- Support access to natural resources for subsistence purposes within Nome and the region by increasing navigation efficiency with the region

Any plan that is implemented as part of this study should take into account cultural, historic, subsistence, and other natural resources. The areas that are evaluated as part of this study have been occupied and/or utilized to varying degrees by federally-recognized Alaska Native tribes for many years. Development at these sites should take into account current and traditional uses.

2.6 Study Constraints

Constraints are restrictions that limit the planning process related to laws, policies, and resource availability. There are no known legal constraints, but the following universal constraints included:

- Minimize adverse impacts to:
  - Threatened and endangered species and essential fish habitat
  - Cultural resources, food security, and access to natural resources minimizing adverse impacts to threatened and endangered species
- The one study-specific constraint included:
  - The Outer Basin dredged depth cannot exceed -28 ft MLLW because of the sheet pile at the existing west causeway docks could become unstable or fail if deeper dredge depths occur near the docks.

2.7 Planning Considerations

Planning considerations were identified and taken into account as the study progressed. These considerations may help guide formulation, but plans were not necessarily selected or eliminated based on these items. Planning considerations developed during the charette and subsequent communications with the non-Federal sponsor are listed below:

- Separation of passenger traffic from industrial traffic on the existing causeway.
- The project should accommodate the international and US-based ice breaker fleet that frequents the area, and other vessels important to National Security.
- For this new project, the City prefers to continue with the placement strategy currently practiced for port maintenance dredge operations by placing future dredge material in front of the existing sea wall east of the port as a beneficial use. This practice has helped build up the beach and protect the sea wall from storm damage.
- Transportation cost saving benefits to national security vessel should be considered when selecting a plan because the Port of Nome is uniquely located in the arctic region to support USCG activities, at a minimum, as a port of convenience for fuel.

2.8 National Evaluation Criteria

Alternative plans should be formulated to address study objectives and adhere to study constraints. Each alternative plan shall be formulated in consideration of four criteria: completeness, efficiency, effectiveness, and acceptability.

- Completeness is the extent to which alternative plans provide and account for all necessary investments or other actions to ensure the realization of the planning objectives, including actions by other Federal and non-Federal entities.

- Effectiveness is the extent to which alternative plans contribute to achieve the planning objectives.
- Efficiency is the extent to which an alternative plan is the most cost-effective means of achieving the objectives.
- Acceptability is the extent to which alternative plans are acceptable in terms of applicable laws, regulations, and public policies. Mitigation of adverse effects shall be an integral component of each alternative plan.

For the NED analysis, average annual benefits are compared to average annual costs expected to be derived from each alternative evaluated. Applying an appropriate discount rate and period of analysis makes costs and benefits comparable to the equivalent time value of money. For this analysis, all costs were calculated using FY2020 price levels and then converted to Average Annual Equivalent (AAEQ) values using the FY2020 Federal discount rate of 2.750 percent (%), with base-year assumption of 2030 assuming a 50-year period of analysis.

Each alternative has a total construction cost estimate, or project first cost, prepared by Cost Engineering utilizing MCASES. The total economic (NED) cost used in the NED analysis is the sum of project first costs, interest during construction, and operation and maintenance expenses. Further discussion of the NED analysis can be found in Appendix D (Economics).

Section 2006 Implementation Guidance allows for selection of a plan based in part or whole on non-monetary units supported by a CE/ICA, as discussed above in Section 1.0. The Section 2006 authority states that in conducting a study of harbor and navigation improvements, the Secretary of the Army may recommend a project without demonstrating that the improvements are justified solely by NED benefits if the Secretary determines that the improvements meet specific criteria as discussed in Chapter 1.0 of this report.

The three criteria listed in Section 2006 (as listed in Section 1.0 above) are met in that:

A. All communities in the region, including Nome, are over 400 miles from a surface accessible commercial port, and have no direct rail or highway link to another community served by a surface accessible port or harbor;
B. The improvements are located in Alaska with over 80 % of the goods transported through the harbor are consumed within the region; and
C. Eleven of the 18 year-round communities in the region are listed as distressed communities (Denali 2018), and their long-term viability would be threatened without the harbor and navigation improvements at Nome (see Section 2.10).

    Additional benefits that the Secretary may consider include the following points. The sub-bullets summarize possible discussion points under each category, and are expanded upon in Section 2.10:

    - Public health and safety

    - Decreasing navigation risks
    - Increasing opportunity for safe moorage by improving facilities
    - Food security
- Access to natural resources for subsistence
    - Increased access to fuel and goods utilized for subsistence through reduced transportation costs
    - Longer or additional subsistence days due to improved access
- Local and regional economic opportunities
    - Reducing transportation costs for fuel and goods through navigation efficiency improvements
- Welfare
    - Protecting public health and safety
    - Promoting economic opportunities
    - Food security
- Social and cultural value
    - Through increased access to subsistence activities, which support teaching activities, traditional foods, and food sharing

2.9 Study Specific Evaluation Criteria

No study-specific evaluation criteria have been identified that are not already captured by the study objectives.

2.10 Long-Term Viability of Communities in the Region

Remote Alaska communities face challenges that are complex and multifaceted. The viability of a community is based on its ability to survive and thrive. Factors impacting community viability include (but are not limited to): economics, costs to add or replace critical infrastructure, risk of relocation, food security and access to resources for subsistence, and outmigration. While it is difficult to quantify a direct link between a Nome navigation project and improvements to the viability of a community, understanding the unique nature of remote Alaska, the role of the hub port at Nome, and how improvements to the port could strengthen the resiliency of the region is critical. According to the American Society for Civil Engineers Infrastructure Report Card for Alaska, “without safe and efficient access to ports and the ocean, the main regional economic driver in many of our communities is gone.” (ASCE, 2017) A discussion of some of the specific challenges faced by villages in the Nome region is below. This includes a qualitative discussion of how the benefits of navigation improvements at the hub port could be felt throughout the region (Section 2.10.7).

2.10.1 Critical Infrastructure

One aspect contributing to the viability of a community is the need to initially construct or replace aging or threatened critical infrastructure. Some villages lack critical infrastructure, some have aging infrastructure that needs replacement, and others are threatened by climate change impacts from thawing permafrost, rising sea levels, more frequent storms, and coastal erosion. High costs associated with building materials in these remote Alaska communities impede necessary upgrades, leading to increased difficulties such as overtaxing aging infrastructure and, in some instances, an increased risk of failure. Examples of critical infrastructure include housing, water and sewer services, transportation facilities (airstrips, ports, barge landings), schools and medical clinics, bulk fuel facilities, and other public structures required for the health and welfare of a community.

2.10.1.1 Housing Security

The Nome region is challenged by a host of issues related to housing security. Issues including housing shortages, aging infrastructure, overcrowding, and affordability combine to create a profound housing quality and affordability problem. Home availability in the region is minimal, with a vacancy rate of 0.3 % (compared to 1.8 % statewide) and rental vacancy rates of 4.2 % (compared to 6.5 % statewide) (Kawerak, 2019). It is projected that 246 new homes would need to be constructed in the region prior to 2025 in order to prevent worse overcrowding (Kawerak, 2019). Existing homes are overcrowded and expensive - nearly 30 % of households in the region are considered overcrowded or severely overcrowded (Figure 4), and more than one-quarter of homeowners with a mortgage pay 30 % or more of their household income for that housing. Adding to the financial burden, energy costs for single-family homes in the region average $6,427 per year - the highest in the state (Alaska Housing Finance Corporation, 2018).

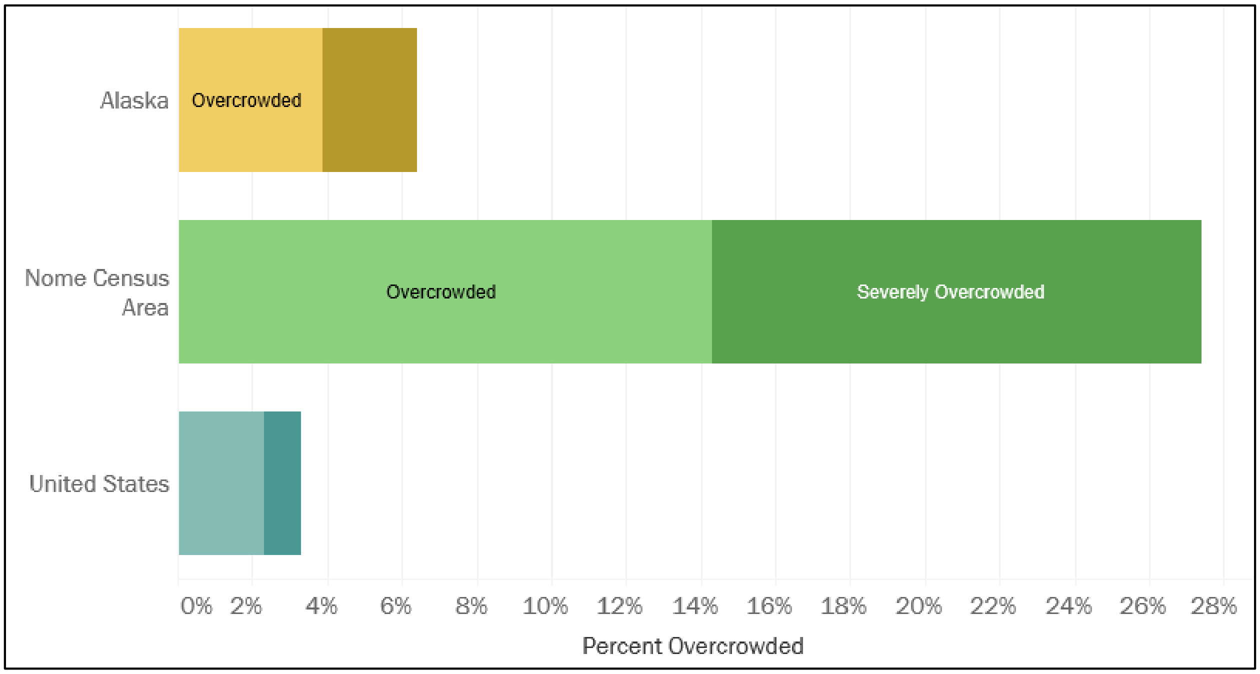

Figure 4. Percent of Overcrowded Homes by Census Area, 2018.
Source: Alaska Housing Finance Corporation

2.10.1.2 Water and Sewer Services

The need for improved water and sewer services is wide-reaching throughout the region – with only four communities (Nome, Unalakleet, Elim, and Shaktoolik) operating with complete water and sewer systems (water distribution and sewer hookups to residential housing). The other communities in the region typically have limited water distribution and sewer, such as connections being limited to public infrastructure such as schools. Individuals rely on a community washeteria for bathing and washing clothes, and as a source for hauled water. In those communities, individuals access a public water outlet to fill containers to haul water back to the home for domestic use. Villages without a water source distribution system to each home typically also do not have sewer hookups, so human wastes are captured in a bucket system for later transportation to the sewage lagoon.

Sanitation deficiency level scores indicate 11 communities have inadequate, unsafe, or no water supply disposal system (Kawerak, 2019). In addition to a lack of water and sewer infrastructure, those communities that do have these services are still particularly vulnerable to infrastructure damage caused by changes in permafrost. For example, in 2017, water and sewer pipes froze and broke in St. Michael due to ground and foundation shifts, which resulted in two months without water or sewer services in the community.

Lack of water and sewer services leads to increased concerns for health and sanitation, and a link has been shown with increased regional incidence of respiratory illnesses as a result (Kawerak, 2019). According to the American Society for Civil Engineers Infrastructure Report Card for Alaska, the lack of access to water and wastewater services "effects the health of Alaskan residents with Alaska having some of the highest rates of pneumococcal, respiratory tract, and gastrointestinal infections in the United States." (ASCE 2017)

Data shown in Table 1 illustrates the high percentages of housing units lacking critical services compared to rates for the Nome region and the state of Alaska. Given a lack of infrastructure in some communities and inadequate systems in others, combined with challenges from climate change, the need for water and sewer improvements in the region is profound.

Table 1. Percent Occupied Housing Units with Selected Characteristics

	Lacking Complete Plumbing (%)	Lacking Complete Kitchen Facilities (%)	Increased Risk of Indoor Air Quality Issues (%)
Alaska	4	3	10
Nome Census Area	23	16	55
Brevig Mission	15	18	95
Diomede	100	78	100
Elim	9	8	81
Gambell	46	40	100
Golovin	50	19	81
Koyuk	24	20	97
Nome	1	2	22
Savoonga	23	33	96
Shaktoolik	3	4	77
Shishmaref	85	45	95
St Michael	33	19	89
Stebbins	96	61	84
Teller	91	50	74
Unalakleet	5	2	52
Wales	100	63	96
White Mountain	28	15	94

Source: Bering Strait Community Needs Assessment Data Book, McDowell Group/Kawerak September 2019. King Island and Mary's Igloo are not likely included in this table by the referenced source because these are seasonal communities.

Using available data, rough order of magnitude costs for water and sewer upgrades were estimated based on full (100 %) or partial (50 %) cost estimates from the Shishmaref 2004 report, updated to current (FY20) dollars. Full water and sewer upgrades are expected for four villages (Gamble, Diomede, Stebbins, and Wales) with partial upgrades are expected for an additional five villages (Brevig Mission, Elim, Koyuk, Savoonga, and St Michael) based off the Bering Strait Community Needs Assessment (the communities of Shishmaref, Shaktoolik, Teller, Golovin, and Unalakleet are not included in these estimates as costs associated with those villages are attributed to relocation. Total costs for water and sewer upgrades are estimated at over 400 million dollars (Figure 5). Cost estimates do not include adjustments for population differences between communities and are based on a rough estimation of the existing infrastructure as listed in the water and sewer system needs inventory by community from the Kawerak 2019 study.

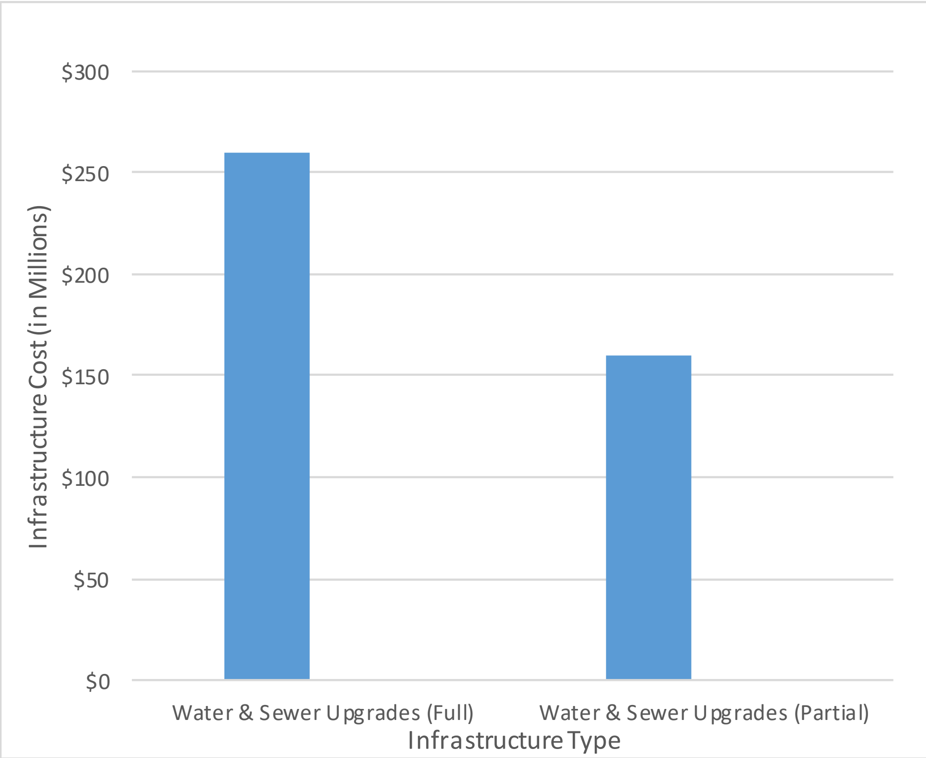

Figure 5. Selected Infrastructure Needs of the Bering Strait Region
Note: Full water and sewer upgrades assumed for the villages of Gamble, Diomede, Stebbins, Wales. Partial water and sewer upgrades assumed for the villages of Brevig Mission, Elim, Koyuk, Savoonga, and St Michael. Costs based off costs for Shishmaref from the 2004 USACE report

2.10.1.3 Schools

The Alaska Department of Education and Early Development Reports to the Legislature, Six-Year Estimates, are cited in the Bering Strait Data Book as estimating nearly 50 million dollars for K-12 school upgrades within the Bering Strait region.

2.10.1.4 Transportation

Limited and unreliable transportation impacts the region through scarcity and isolation. No roads connect the region to the rest of the state of Alaska, and most communities are isolated from each other, at least seasonally. Air transportation is expensive and weather dependent. Among other challenges, this leads to increased costs for basic goods and services. When looking at a family of four with children 6 to 11 years of age, for example, the cost of groceries for a week in Nome is 131 % of the Alaska average.

Costs in smaller communities within the region are even higher (UAF Cooperative Extension Service, December 2017).

2.10.2 Poverty and Unemployment

Each year, an annual update of the communities that are distressed in the state is conducted. Distressed status is determined by comparing average income of a community or CDP to full-time minimum wage earnings, the percentage of the population earning greater than full-time minimum wage earnings, and a measure of the percentage of the population engaged in year-round wage and salary employment. Of the 18 year-round villages within the BSNC region, 11 are listed as distressed communities in the Distressed Communities Report dated June 2018 (Denali 2018). The average number of communities within the Nome Census Area that are included on this list has continued to grow over time, showing a trend of increasing economic distress (Figure 6).

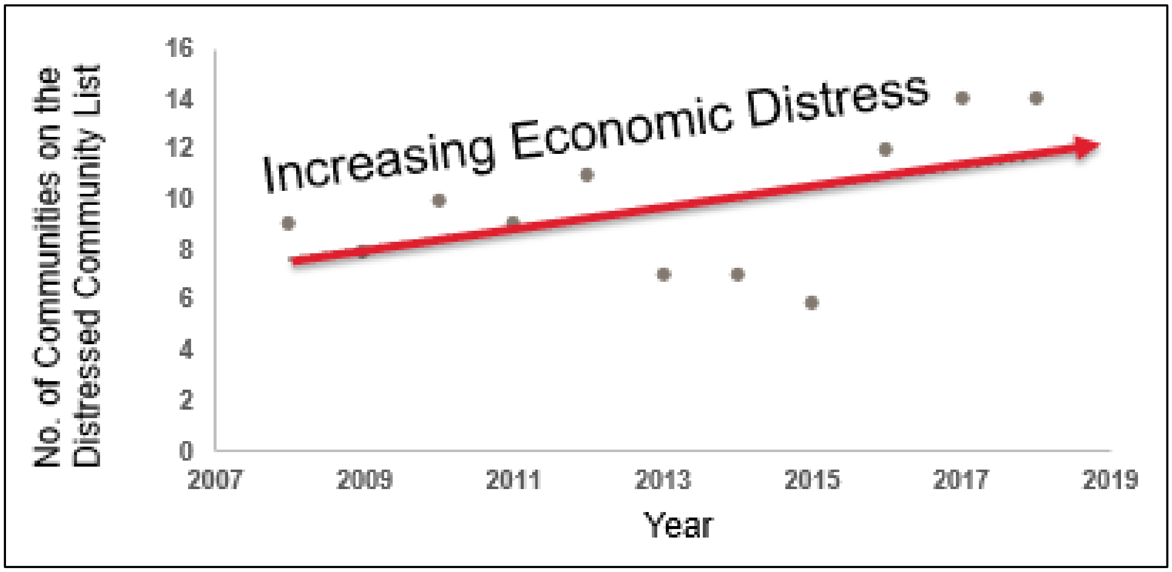

Figure 6. Number of Nome Census Area Communities on the Distressed Communities List, 2007-2018.

Note: 2018 Distressed Communities include: Brevig Mission, Elim, Gambell, Koyuk, Savoonga, Shaktoolik, Shishmaref, Stebbins, Teller, Wales, and White Mountain. Source: 2018 Distressed Community Report, Denali Commission, June 2018.

Unemployment rates in the region are nearly double the unemployment rate for the state of Alaska, 11.6 % for 2018 in the Nome Census Area compared to 6.6 % for the state of Alaska. One-quarter of residents in the Nome Census area are below the poverty line, compared to 10 % of Alaska residents (McDowell Group, September 2019).

2.10.3 Food Security

Food security for villages in remote Alaska is influenced by a combination of factors. Individuals utilize tools (boats, snowmobiles, ATV's, etc.) to access subsistence harvest sites, which require fuel in order to operate. Costs for these resources are high in remote Alaska communities. Distances and the level of effort required to reach subsistence sites can vary depending upon climate conditions, seasonality, and the resource being targeted, and resulting harvest levels are also variable. While subsistence foods are preferred on both a cultural and nutritional basis, community members rely on a combination of packaged and subsistence foods for their survival.

While food scarcity is certainly impacted by limited transportation infrastructure, changes in culture and climate are additional factors. Access to subsistence food resources is changing as a result of shifting climate and changes in sea ice. After a poor walrus harvest in 2015, four communities (Diomede, Gambell, Savoonga, and Wales) declared states of economic disaster because of food shortages. Donated fish boxes were delivered to the communities, though nutritional values were not fulfilled like they would have been with walrus. Food security and nutrition are a concern throughout the region, which is shown in responses to a survey that was conducted for the Bering Strait Community Needs Assessment. In that survey, 34 % of households with children in the Kawerak Service Area indicated that there is not adequate healthy food for children; more than one-quarter of respondents with children in each community reported not having enough healthy food for their children in the past year (Kawerak, 2019).

2.10.4 Outmigration

When looking at the viability of a community, outmigration becomes a key indicator of the health of a community and/or region. Within the region, four communities (Council, King Island, Mary's Igloo, and Solomon) have all experienced population decline to a point where they are only inhabited seasonally – with no year-round residents remaining. Those who previously inhabited these communities have relocated, many to neighboring villages or to the hub community of Nome (such as the King Island Native Community relocating to Nome, and the Mary's Igloo Traditional Council now based out of Teller).

During the ten year period from 2009 through 2018, migration out of the Nome Census Area resulted in more people moving out of the area than in (known as negative net migration). However, population change includes additional factors such as births and deaths, which has led to overall population growth in the region during that period (Kawerak, 2019). Due to this complexity, while the overall population shows growth, negative net migration reveals concerns for the long-term viability of the region and the individual communities within it. Migration is discussed in more detail in Section 3.5.2 Migration, and Appendix D (Economics).

2.10.5 Climate Change

The impacts of climate change are being experienced in coastal Alaska with a high degree of severity. Shore-fast sea ice (which historically has protected villages from storm-driven wave action) is forming for shorter durations, if at all, leaving the communities exposed to environmental challenges such as erosion and flooding. Homes and infrastructure are also being damaged by thawing permafrost. Access to subsistence resources is changing as the sea ice environment changes, which impacts traditional practices. Villages are having to adapt to these increasing threats, and some are even being driven to relocate as climate change impacts overwhelm their ability to adjust.

According to a 2019 Statewide Threat Assessment, five of the top ten communities statewide (as ranked for highest combined climate change risk including erosion, flooding, and thawing permafrost) are in the Nome region ([1] Shaktoolik, [2] Shishmaref, [4] Golovin, [8] Unalakleet, [9] Savoonga) (Denali Commission, 2019).

Statewide cost estimates on the impact to public infrastructure from thawing permafrost, erosion, and flooding have been forecast at a possible $5.6-$7.6 billion through 2080 for Alaska. While that damage estimate is calculated for the entire state, the analysis highlights that “Alaska coastal and riverine infrastructure is particularly vulnerable to flooding and erosion induced by climate change” (Larsen, 2008) therefore construction costs to armor, floodproof, or even relocate critical infrastructure is likely to be significantly higher in the Nome region than in other interior locations within the state.

2.10.6 Relocation

The viability of some villages in the region and the safety and quality of life for the residents of those villages is so threatened by climate change that they are considering relocation (such as in the case of Shishmaref, Shaktoolik, Teller, Golovin, and Unalakleet).

Rough order of magnitude costs are estimated for community relocation based off costs from the 2004 Shishmaref Relocation and Collocation Study (USACE, December 2004) updated to current year (FY2020) dollars using the Civil Works Construction Cost Index System (CWCCIS) and annual costs for Buildings, Grounds and Utilities. The total rough order of magnitude cost for immediate relocation of two villages (Shaktoolik and Shishmaref) and phased relocation of an additional three villages (Teller, Golovin, and Unalakleet) totals over 1 billion dollars (Figure 7). Cost estimates do not include adjustments for population differences between communities, distance between sites, and any sunk costs for previously built infrastructure already at a relocation site. However, the proxy costs are still reasonable as a rough order of magnitude given the existing and required infrastructure needs are very similar across villages, all are within the same geographic region, and populations of the villages range between 163 and 722 individuals with the proxy village population of 598 falling within that range

(population estimates for July of 2018 from the Alaska Department of Labor and Workforce Development.)

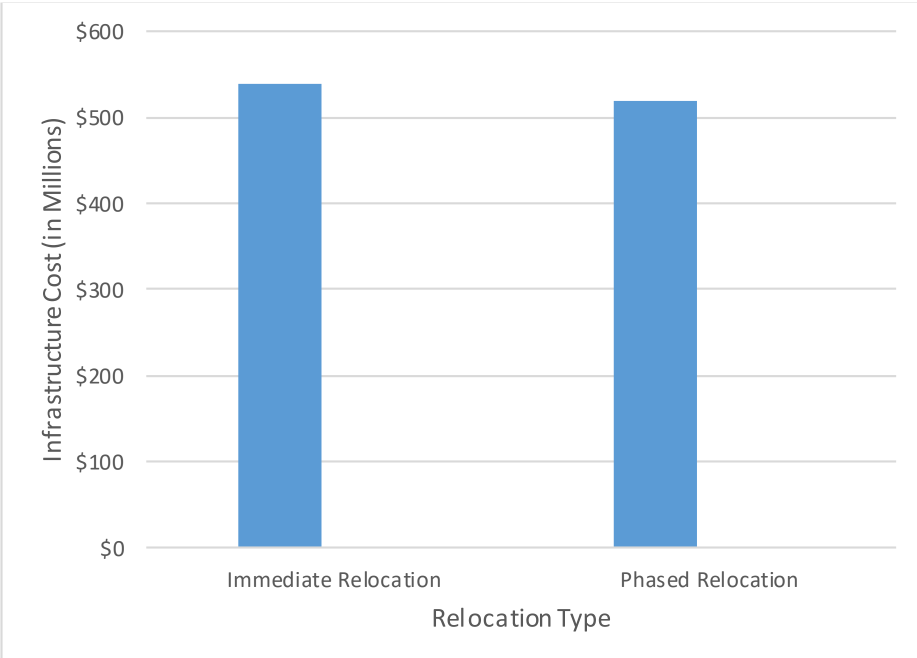

Figure 7. Village Relocation Costs in the Bering Strait Region Due to Climate Change
Notes: (1) Immediate Relocation assumed for the villages of Shaktoolik and Shishmaref, with costs based off Shishmaref relocation costs to a new mainland site from the 2004 USACE report. (2) Phased Relocation assumed for the villages of Teller, Golovin, and Unalakleet, with costs based off averaged costs for Shishmaref collocation to Nome and Kotzebue from the 2004 USACE report

2.10.7 "Stemming From" Effects

Feedback from focus group interviews and other information gathered during the study identified effects stemming from more efficient delivery of fuel and goods in the region. These effects tie directly into the considerations of Section 2006 WRDA 2007, as amended, of public health and safety, regional economy, access to subsistence resources, welfare, and cultural values. They also tie directly to the drivers of viability discussed above of economy, infrastructure, relocation, subsistence, and outmigration.

More efficient fuel and goods deliveries could provide opportunities to perform additional (longer and more frequent) subsistence activities, make resources for subsistence (boats, snow machines, ATVs) more accessible, and free up other resources or funds to utilize on subsistence. Subsistence is critical to food security for families in this region, builds a healthy populace through traditional foods, and supports cultural values through participation in teaching and learning of skills and through sharing of food. Food security impacts survival, health, education, and the ability to remain in the community.

More efficient fuel and goods deliveries could provide a more accessible source of heating fuels. Ninety-one percent of the region heats their homes with fuel oil, and many communities utilize generators for their power. It can also provide better resources for maintaining homes and may also provide opportunities to save for travel-related costs that are needed for medical/dental or social services. These are life-sustaining resources and impact the ability to remain in the community. In addition, improved housing conditions relate to the retention of professionals (medical, dental, education, safety) in the communities.

More efficient fuel and goods deliveries could also assist the region in addressing critical infrastructure and relocation needs, as discussed above. As facilities are initially constructed, repaired, or maintained, the regional economy is impacted. These facilities help the region provide for the health, safety, cohesion, and cultural practices of their communities.

Potential stemming from effects and how they relate to the Section 2006 considerations and viability indicators are presented in Table 2. The first column identifies the primary impact. The second to fourth column (tier 1, 2, 3) considers the effects that may stem from the impact. The last two columns identify the Section 2006 and viability factors.

2.10.8 Viability Summary

The challenges faced by the region with or without a project include:

- need to initially construct or replace aging or threatened critical infrastructure;
- the economic information shows a trend of increasing economic distress in the region;
- food security for traditional foods is threatened by the high cost of fuel and equipment to participate in the subsistence lifestyle in remote Alaska communities;
- outmigration has already resulted in the loss of one village, King Island; and
- climate change impacts to infrastructure is likely to be significant in the Nome region.

With improved access to the villages through upgrades to the hub port, there is the potential for efficiencies to be gained when addressing these long-term viability concerns throughout the region and providing the opportunity for improving self-determination potential with in the region.

Table 2. Stemming from Effects

Impact in Future With Project-Primary/Catalyst Effect	Relevance to Viability - Stemming From Effects			Tie to Section 2006 Consideration	Tie to Indicators of Threatened Viability(At Risk in Future Without Project)
	Tier 1	Tier 2	Tier 3		
Improved efficiency of fuel delivery to the region	Available cash/more affordable resources to pursue subsistence	Food security Food sharing Traditional foods Training of youth	Reduced outmigration	Health & safety Wellness Access to subsistence resources Cultural values	Subsistence Outmigration
	Reduced cost of travel for medical	Access to healthcare Available cash for subsistence	Reduced outmigration	Health & safety Wellness	Economics Outmigration
	Reduced cost of heating homes	Professional retention Available cash for subsistence	Reduced outmigration	Health & safety Wellness	Economics Outmigration
Improved efficiency for delivery of durable goods	Available cash to pursue subsistence	Food security Food sharing Traditional foods Training of youth	Reduced outmigration	Health & safety Wellness Access to subsistence resources Cultural values	Economics Subsistence Outmigration
	Reduced cost to build, maintain or repair homes	Increased home maintenance	Reduced outmigration	Health & safety Wellness Cultural values	Economics Outmigration
Improved efficiency for delivery of critical infrastructure & components (new construction & replacement) (municipal)	Available cash to rebuild critical infrastructure	Availability of sanitary facilities, fuel storage, water storage, local roads, barge landing facilities	Employment Professional retention Reduced outmigration	Regional economy Health & safety Wellness	Economics Critical Infrastructure Outmigration
	Reduced cost to maintain or replace public health and community facilities	Availability of washeteria, health clinics, housing, schools	Employment Professional retention Reduced outmigration	Regional economy Health & safety Wellness	Economics Critical Infrastructure Outmigration
	Lower cost of supplies used to combat effects of climate change	Availability of critical infrastructure and public facilities	Employment Professional retention Reduced outmigration	Regional economy Health & safety Wellness	Economics Critical Infrastructure Outmigration Relocation
Improved efficiency for delivery of construction materials (municipal)	Lower cost of construction materials	New construction Increased maintenance Longer building life	Employment Professional retention	Regional economy Health & safety Wellness	Economics Critical Infrastructure Outmigration
	Lower cost of supplies used to combat effects of clmate change	Employment Professional retention	Reduced outmigration	Regional economy Health & safety Wellness	Economics Critical Infrastructure Outmigration Relocation

3.0 BASELINE CONDITIONS / AFFECTED ENVIRONMENT*

3.1 Physical Environment

3.1.1 Climate (Temperature & Precipitation)

Both maritime and continental conditions influence the study area climate. Maritime dominates during the summer as it is influenced by the Norton Sound and Bering Sea (see Figure 2), while in the winter, conditions shift to a mostly continental climate. The average annual temperatures are about 27 degrees F (U.S. Climate Data 2019). July is the warmest month, with an average temperatures range of 46 to 58 degrees Fahrenheit (F). January is the coldest month, with an average temperature range of 13 to minus 3 degrees F (Figure 8).

.Average annual precipitation is 16.48 inches as rainfall and 77 inches as snowfall. August is the highest average precipitation amount of 3.23 inches, and March has the lowest average precipitation of 0.67 inches (Figure 9).

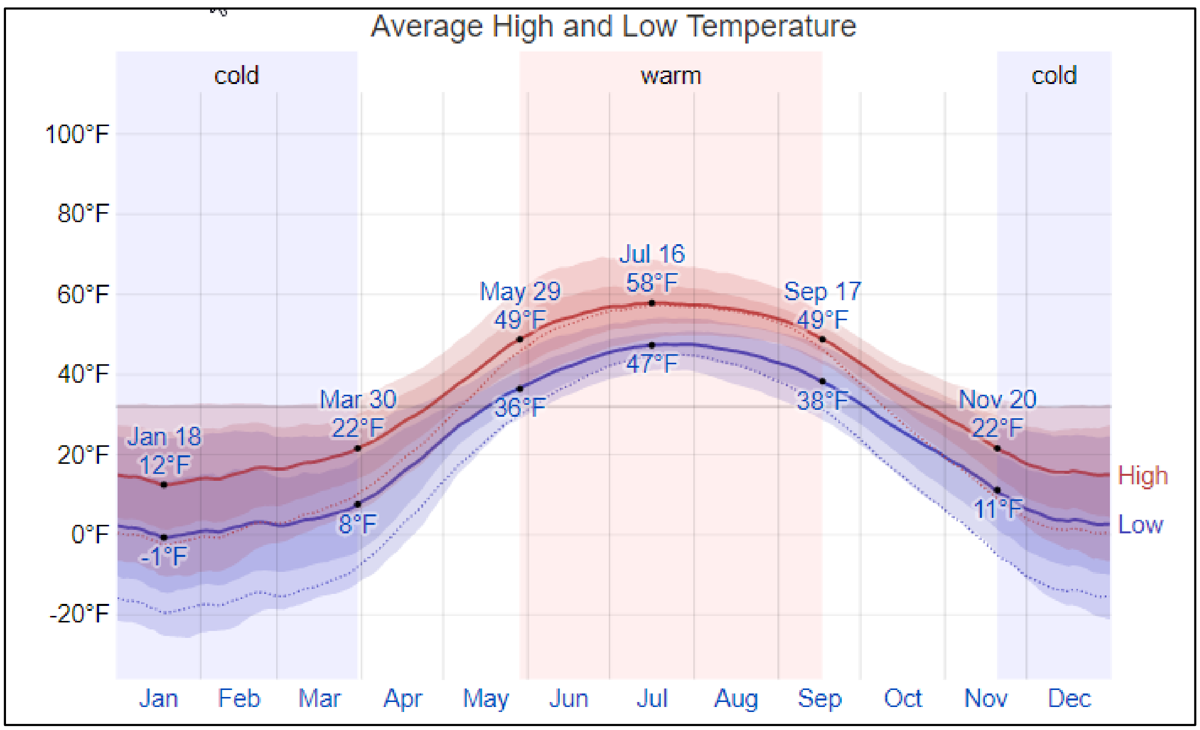

Figure 8. Average Monthly Temperature Graph (Source: Weather Spark 2019).

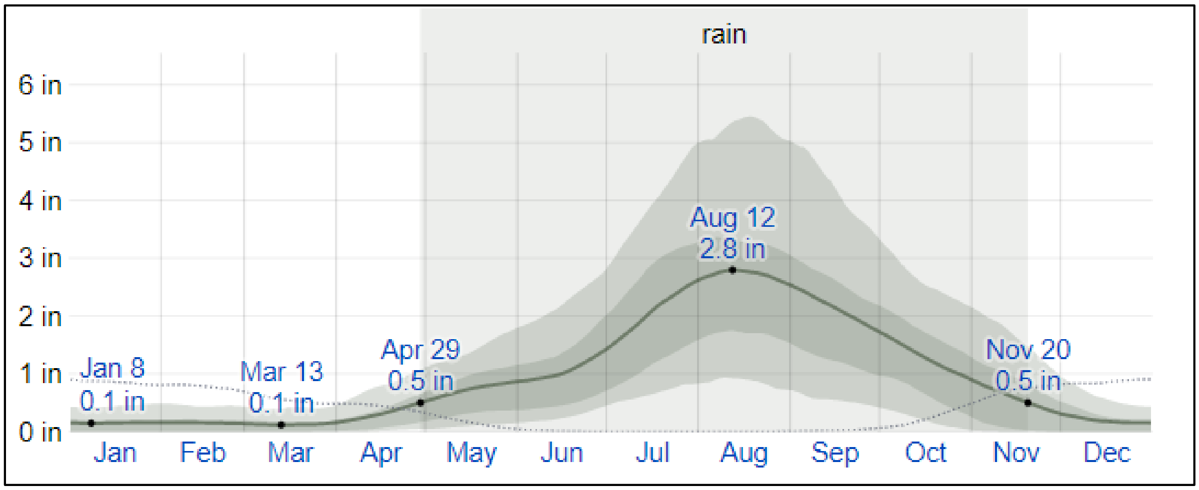

Figure 9. Average Monthly Rainfall (Source: Weather Spark 2019).

The average rainfall (solid line) shown in Figure 9 accumulated throughout a 31-day period centered on the day in question, with 25th to 75th and 10th to 90th percentile bands. The thin dotted line is the corresponding average liquid-equivalent snowfall.

According to the Fourth National Climate Assessment (2017, Vol. 1), a warming trend relative to average air temperatures recorded from 1925 through 1960. A trend of increasing temperatures starting in the 1970s has been identified and is projected to continue throughout the state of Alaska. The largest temperature increases have been found in winter months with average minimum temperature increases of around 2 degrees Fahrenheit statewide. Annual maximum one-day precipitation is projected to increase by 5%–10% in southeastern Alaska and by more than 15% in the rest of the state, although the longest dry and wet spells are not expected to change over most of the state.

3.1.2 Wind

Nome Airport hosts a weather station which has been operational since 1970. The predominant wind directions are from the north and east for the entire year (Figure 10).

Calm conditions, wind speeds 0 to 2 miles per hour are present 11 percent of the time. The average wind speed is 8.6 knots. Wind speeds exceeding 15 knots are mainly from the west, southwest, and south directions during June through September 2019 (Figure 11).

Wind speeds exceeding 15 knots are predominantly from the east and northeast directions during the fall, winter, and spring months. Wind Speed Exceedance Probability Chart for the Nome Airport is shown in Figure 12.

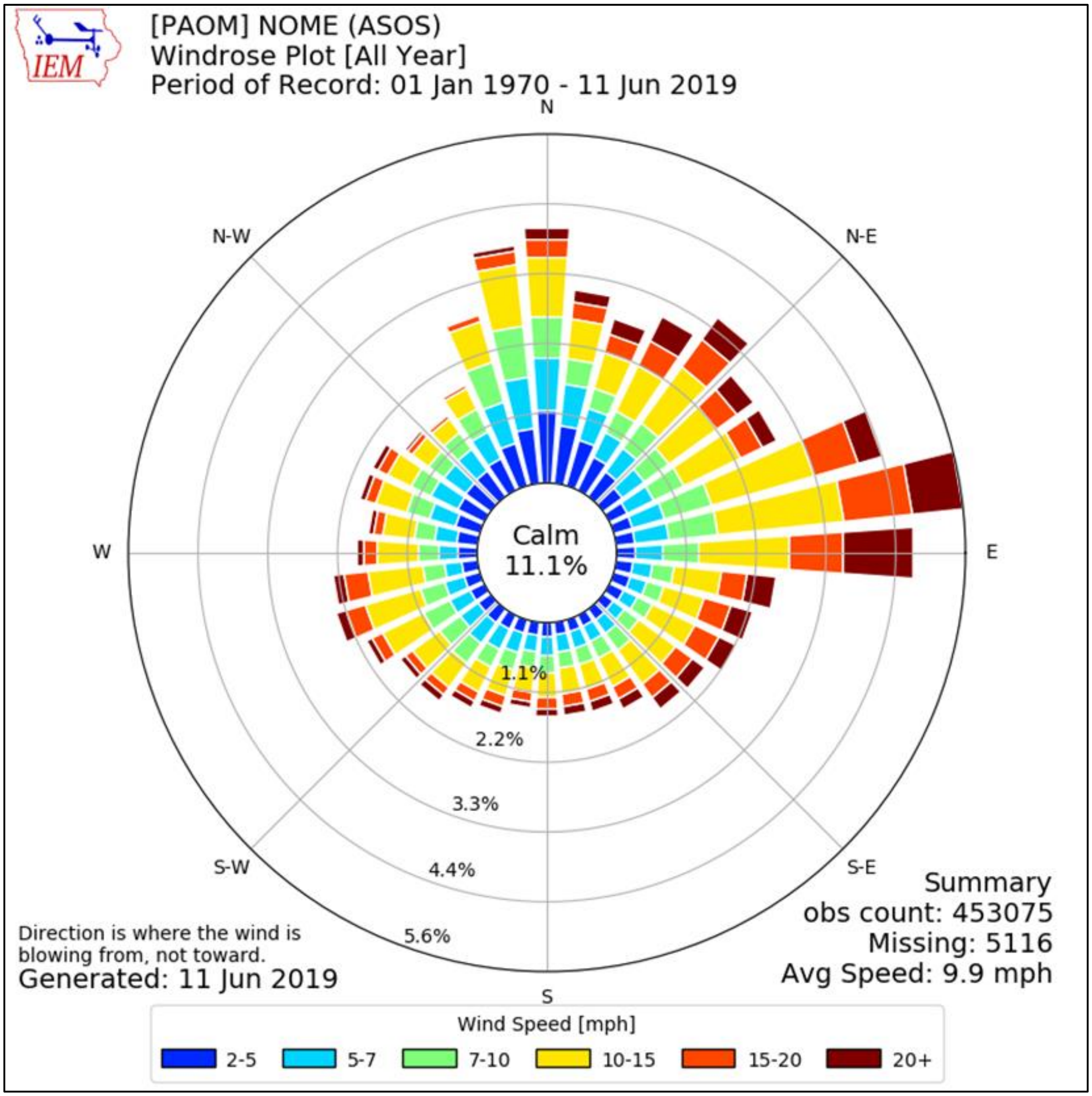

Figure 10. Windrose for the Nome Airport – All Year (Source: ISU 2019)

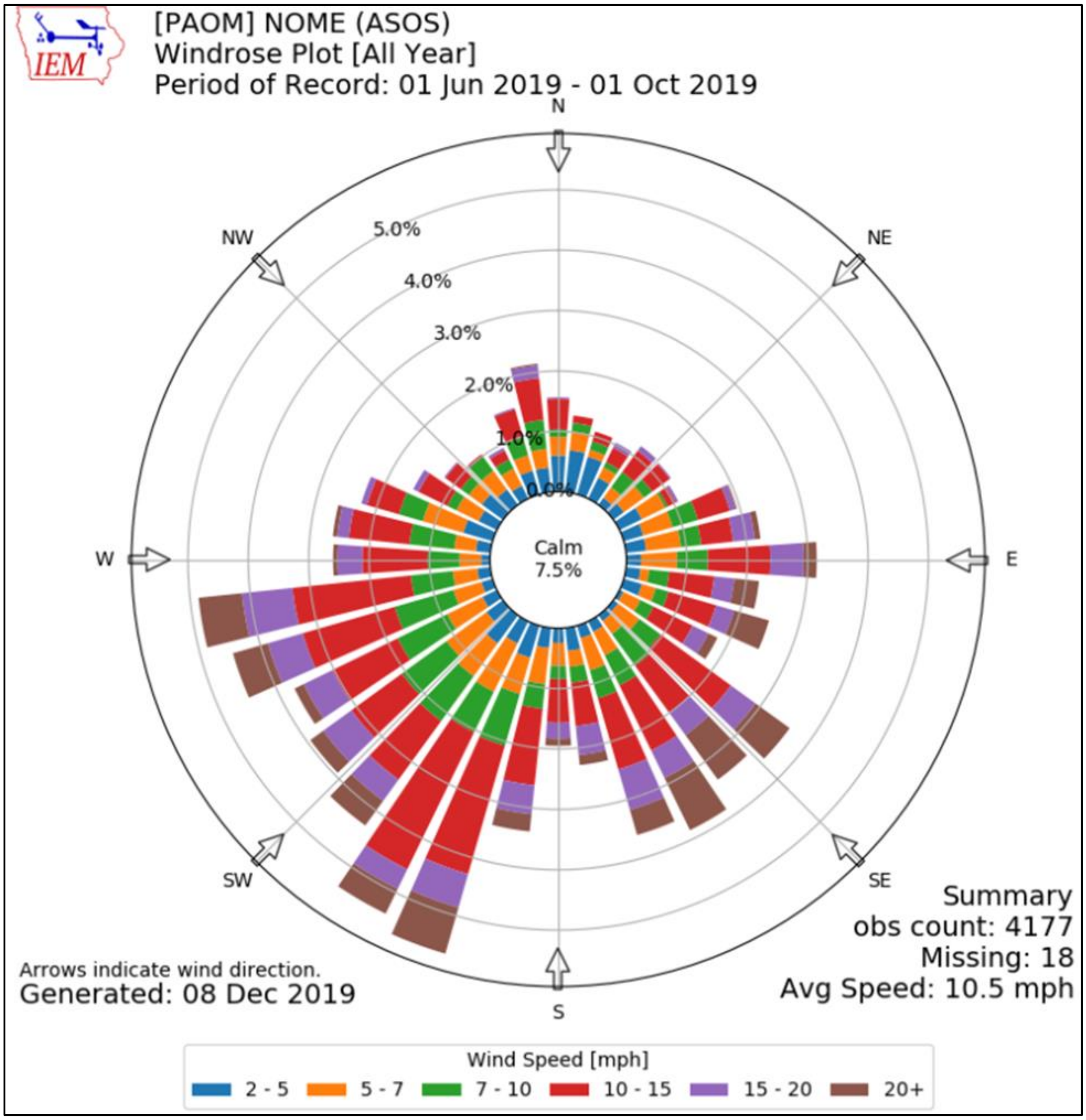

Figure 11. Windrose for the Nome Airport – 01 June to 01 October 2019 (Source: ISU 2019

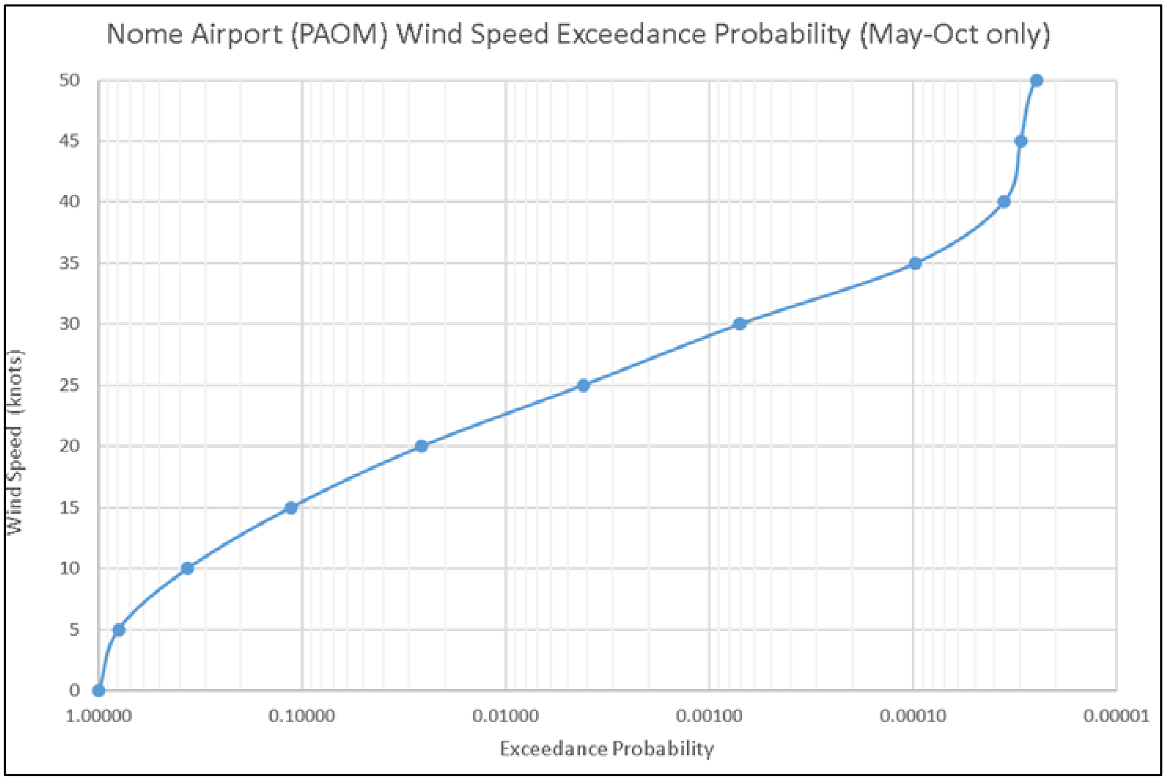

Figure 12. Wind Speed Exceedance Probability Chart for the Nome Airport

3.1.3 Ice Conditions

3.1.3.1 Sea Ice

The National Oceanic and Atmospheric Administration (NOAA) began publishing an annual, peer-reviewed Arctic Report Card in 2006. The 2018 Report Card (NOAA 2018a) states that the Arctic sea ice cover is continuing to decline in the summer maximum extent and winter minimum extent (Perovich et.al., 2018). The minimum sea ice extent usually occurs in late September. In 2018, the ice cover was 26 % lower in late September than the average coverage between 1981 and 2010 and was tied for the 6th lowest ice coverage since 1979. With a decreased sea ice extent, there is an increase in time that the subarctic (i.e., Norton Sound) is ice-free or has limited sea ice coverage. A more extended ice-free season could potentially expose the region to additional storms and associated damages that would have been mitigated by ice cover.

The seasonal formation and retreat of sea ice drives much of the ecology in the Bering Sea, from primary production to the distribution of marine mammals. All sea ice within the Bering Sea forms and melts within a single season, with no multi-year ice component, as is found in the Chukchi and Beaufort Seas. Sea ice covers much of Norton Sound from roughly November to May, and forms as shorefast, or landfast, ice. Decreasing temperatures and surface winds freeze the relatively shallow, lower-salinity waters along the shore; the sheet of ice anchored to the shoreline and seafloor continues to freeze and expand seaward (NOAA 2018a).

At Nome, the seaward edge of shorefast ice typically extends as far as the 66-ft depth profile (a little over two nautical miles). Strong winds can break away large pieces of shorefast ice, which then move about according to winds and currents. The thickness of shorefast ice in Norton Sound is variable but can approach 4-foot ridges or keels of ice can extend from the ice sheet down to the seafloor in water as deep as 66 ft (RJW 2013). Shorefast ice typically generally only extends down to 22-ft depths offshore of Nome (Charlie Lean 2019). These ice keels can gouge the seafloor, especially as the shorefast ice breaks up in spring, causing significant disruption to the seafloor habitat. Late-melting floating ice, called “longer lingering ice,” can persist in some areas after the breakup of shorefast ice for weeks into spring and early summer. This type of ice is often found off of Nome and serves as an essential resting platform for migrating ice seals and walrus (Oceana and Kawerak, Inc. 2014).

Areas of open water within the sea ice are called polynyas or leads. Some polynyas form in roughly the same area every season and persist through the winter, kept open by upwelling waters, consistent winds, or tidal currents. These openings provide important overwintering areas and migration corridors for sea mammals and birds. Openings in the ice allow sunlight to penetrate the water column in spring, accelerating early phytoplankton growth. A recurring polynya forms off of Nome and the northwest Norton Sound coast, along the seaward edge of the shorefast ice (Oceana and Kawerak, Inc. 2014).

Ice conditions within the project area include sea ice and shorefast ice (Appendix C [Hydraulic Design], Chapter 2). For the Nome area, sea ice formation typically occurs in early November each year; however, some years freeze-up in Norton Sound took place in mid-October. Spring break-up usually occurs in late May. Fast ice is sea ice of any origin that remains attached to shoreline features along the coast, such as the existing breakwater, causeway, and seawall. Fast ice typically extends out from shore from 0.5 miles to approximately 7 miles depending on seasonal conditions. Nearshore, the ice tends to be relatively smooth out to about 0.25 mile. From there, the ice tends to become buckled offshore, where the influence of pressure ridges are evident. Areas of large pressure ridges and possibly grounded pack ice were observed in recent years at the entrance to the navigation channel between the spur and main breakwaters. Early winter ice sheet thicknesses of approximately one foot are typical. Maximum thicknesses of about 4.5 ft are predicted from computed freezing-degree-day estimates of ice growth. During years where pressure ridges are formed, estimated ice thicknesses at the ridges have been as great as 30 ft.

3.1.3.2 Snake River

The Snake River flows through the west side of the Inner Harbor before discharging into the Outer Basin (see Figure 1). River ice forms by the end of November each year, although earlier freeze-ups can occur during late September to any time in October, depending on seasonal weather patterns (Appendix C [Hydraulic Design], Chapter 2). The upstream part of the river tends to freeze up first, while the downstream portion near the mouth at the navigation channel freezes last. Spring break-up typically occurs in mid-May, before the break-up of the pack ice in Norton Sound. With increased river discharge in May, open leads begin to form in the navigation channel and tend to accelerate the pack ice breakup between the causeway and main breakwater. Little ice from the river itself flows down the channel to the mouth, and river ice jams have not been observed in the area.

3.1.4 Bathymetry

The natural bathymetry offshore of the current port drops off gradually down to –50 ft MLLW and greater approximately 3,200 lineal feet seaward (south) of the existing Outer Basin entrance (Figure 13). The entrance channel to the Outer Basin has a natural depth of -26 ft MLLW. The bathymetry within the port is altered by dredging in both the Inner and Outer Basin (see Figure 3).

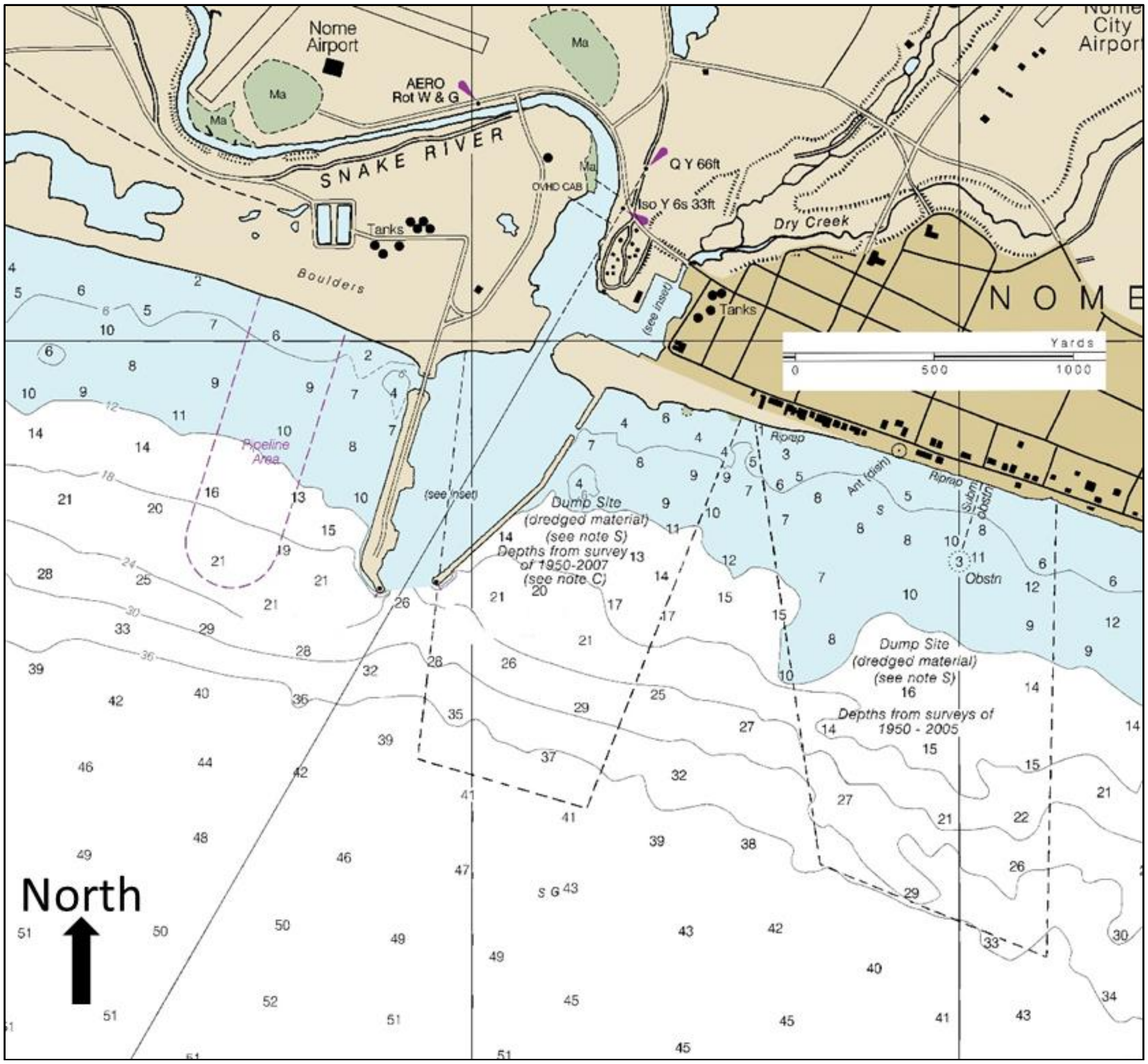

Figure 13. Bathymetry Map

3.1.5 Soils / Sediments

Marine, glacial sand and gravel underline the surface sediments of the Nome coastal plain and adjacent offshore areas. At least six distinct deposits are recognized onshore, relic “beaches,” marking six different coastline elevations during the geologic past (Figure 14). These deposits are, in turn, underlain by schist and limestone bedrock, which is exposed at higher elevations north of the coast. The marine and glacial deposits of sand and gravel extend offshore, where they are intermixed with marine silt and clay (Tagg & Greene 1974, MMS 1991).

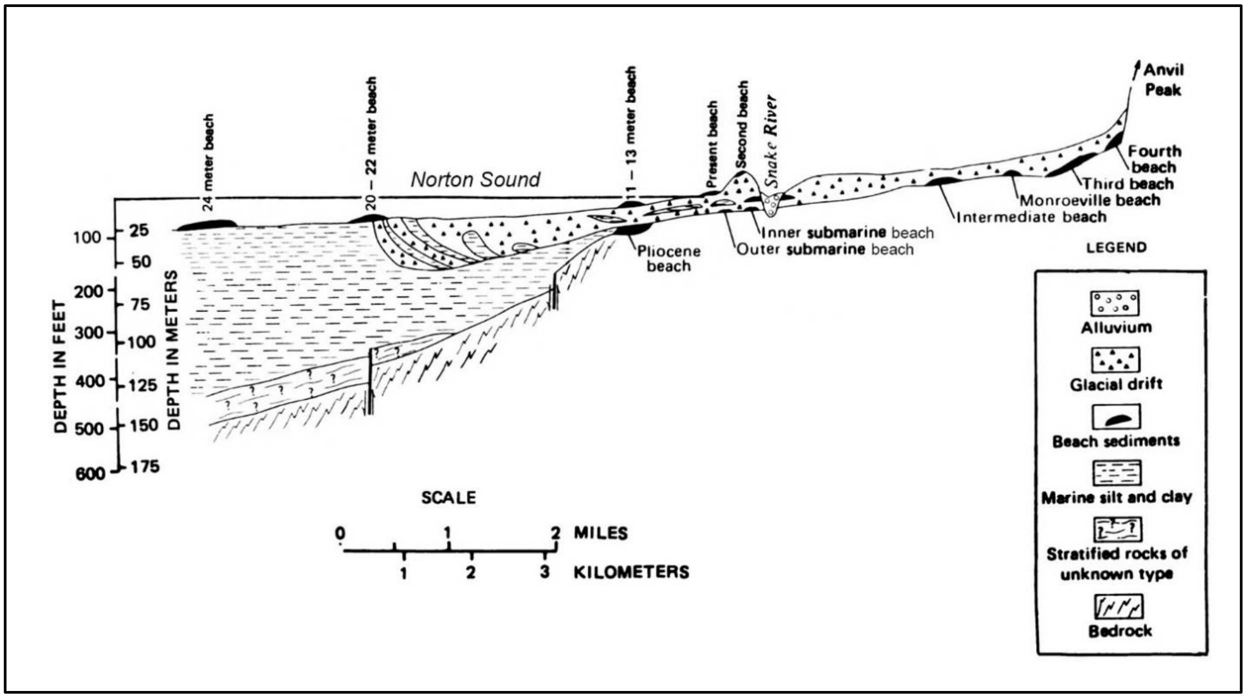

Figure 14. Generalized profile of major geological strata near Nome (adapted from MMS 1991).

A review of existing geotechnical information from the Port of Nome area is provided in Appendix B. The only known offshore borings in the project area are from a 1982 geotechnical investigation performed for the City of Nome by Harding Lawson Associates in support of construction of the existing causeway. Subsurface conditions below the causeway consist of four strata consisting of recently deposited sediment underlain by three identifiable older deposits

a. Silty sand with a trace amount of gravel (recent deposition) to depths -5 to -37 ft MLLW
b. Gravelly silty sand (glacial till) to depths of approximately -15 ft to -47 ft MLLW
c. Silty fine sand (older marine deposits) to depths of approximately -35 ft to -71 ft MLLW
d. Sandy gravel rubble to depths of approximately -45 ft to -72 ft MLLW

Below the sandy gravel, weathered micaceous schist bedrock was encountered to a maximum depth explored (-77 ft MLLW). The recent deposits, glacial till, and older marine deposits were determined to be medium to dense, medium to very dense, and dense to very dense, respectively.

Geotechnical investigations would need to be performed within the project footprint during preconstruction engineering and design (PED) to properly characterize the proposed dredge material, evaluate and recommend the suitability of breakwater foundation material, and identify any geological conditions that would require special foundation treatment.

3.1.5.1 Hazardous, Toxic, and Radiological Waste (HTRW) Issues for Sediment

The new work dredge material would require chemical characterization, as no chemical data are known to exist for offshore sediments at depth. Previous sampling and chemical analysis of surface sediments within the Inner Harbor has shown little indication of the sort of human-caused chemical contamination typically found in small boat harbors, such as fuels. In the Outer Basin, annual maintenance dredging and a lack of history of significant contaminant releases suggest that the offshore sediments should also be free of contamination. However, notably high concentrations (up to 200 mg/kg) of the metallic element arsenic have been reported regularly in sediment samples from the Inner Harbor area and from Snake River (Northwestern Aquatic Services 1991, Woodward-Clyde 1998, USACE 2000, Bristol 2013, USACE 2014, USACE 2017, USACE 2018). Significant concentrations of arsenic in some Seward Peninsula mineral formations and in the sediments of area streams (including Snake River) are well documented (USKH 2012). Arsenic-sulfide compounds are commonly associated with gold ores (Straskraba and Moran 2006), and the Nome area has been the scene of intense gold mining for more than a century. The presence of natural sources of arsenic and the lack of identifiable human-generated sources of arsenic at the Nome Harbor indicate that the high concentrations of arsenic detected in many samples of the harbor sediment are due primarily to local mineralogy, although arsenic-rich sediments may have been mobilized by the processing of arsenic-bearing ores during mining operations. Soil samples taken from borings along the Nome Spit in 2000 also showed consistently high levels of arsenic (up to 93 mg/kg), even at depths of greater than 20 ft below the surface (USACE 2001), suggesting that the material that formed the spit is also rich in arsenic-containing minerals.

The State of Alaska has not established marine sediment standards. The dredged material management guidelines (DMMO 2018) currently used by the USACE Alaska District have established a marine sediment screening level of 57 mg/kg total arsenic, based on published Lowest Apparent Effects Thresholds (LAETs). This screening level presumes, however, that the arsenic present is due to man-made contamination, rather than naturally-occurring minerals. The actual toxicity and bioavailability of the arsenic in the Nome Inner Harbor sediments is uncertain. A bioassay performed in 1991 (Northwestern Aquatic Sciences 1991) was inconclusive, suggesting mild toxicity to standard test organisms from Inner Harbor sediment relative to Snake River sediment, but not ruling out ammonia in the harbor sediment as the primary toxin rather than arsenic.

Arsenic concentrations of surface sediment samples collected in 2016 and 2017 from Snake River, Nome Harbor, and along the outer shoreline are shown in Figure 15. The high variability of arsenic concentrations reported may be due to “nugget effects,” in which a small fraction of high-arsenic particles may skew the analytical results for that sample; localized selective sorting of high-arsenic particles by density or grain-size may also play a role. The relatively low variability of arsenic concentrations in shoreline sediment samples taken east of the Outer Basin may be due to a homogenizing effect by the annual suction-dredging of sediments before they are discharged at the beach nourishment placement site (Figure 15).

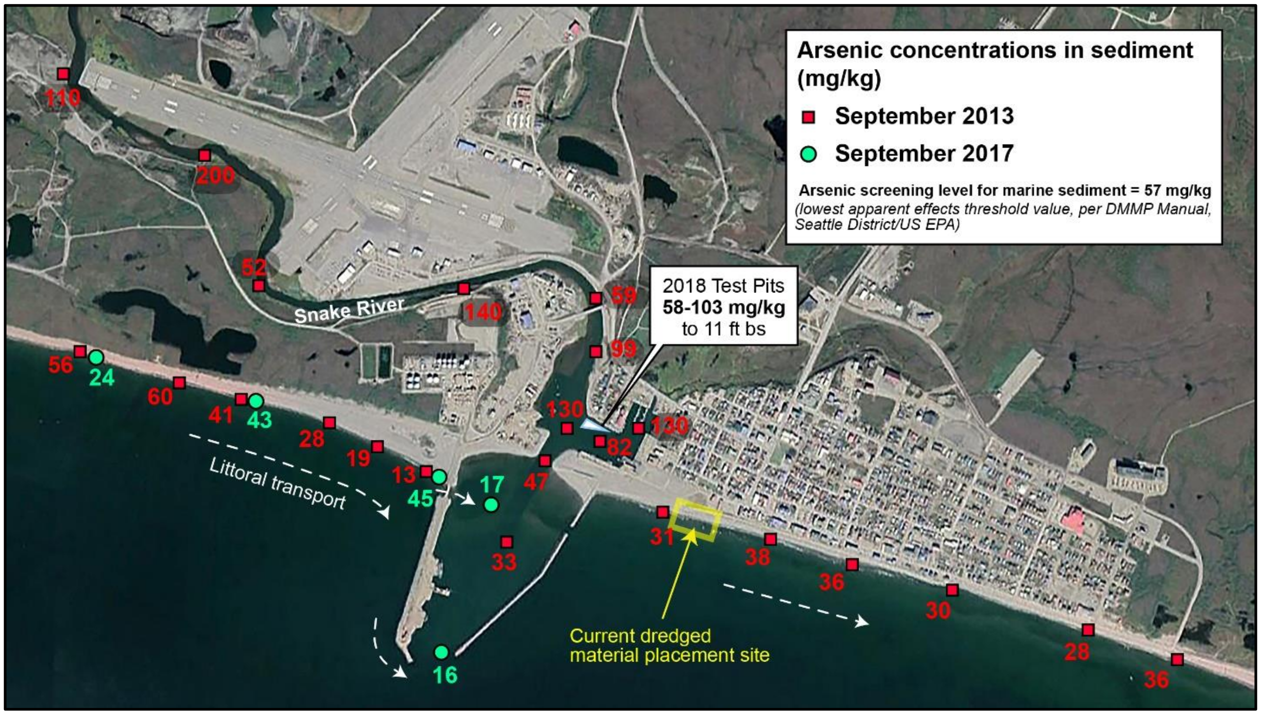

Figure 15. Background surface sediment arsenic concentrations.

3.1.6 Tides / Currents / Stream Flow

3.1.6.1 Tides

The tidal influence at Nome is relatively small, and the tides are primarily diurnal. Much larger water surface elevation fluctuations occur at Nome due to storm surges. The mean tide level (arithmetic average of the Mean High Water and the Mean Low Water) is 0.82 foot, and the mean tide range (the difference between Mean High Water and Mean Low Water) is 1.03 ft (Table 3).

Table 3. Published Tidal Data for Nome Alaska

Description	Tide Level (ft)
Highest Observed Water Level (19 October 2004)	+9.83
Mean Higher High Water (MHHW)	+1.52
Mean High Water (MHW).	+1.33
Mean Sea Level (MSL)	+0.82
Mean Tide Level	+ 0.81
Mean Low Water (MLW)	+0.30
Mean Lower Low Water (MLLW).	0.00 (datum)
Lowest Observed Water Level (11 November 2005)	-6.69

Source: NOAA NOS, Tidal Epoch 1983-2001, published 10/06/2011.

3.1.6.2 Currents

Norton Sound is an extension of the northern Bering Sea but is hydrologically distinct from much of that region. The northern Bering Sea features strong oceanic currents flowing north into the Bering Strait, driving an oceanic ecosystem fed by the upwelling of nutrient-rich deep water to the ocean surface. The shallow, partially confined Norton Sound, on the other hand, is characterized by an inshore ecosystem that receives most of its nutrients from the Yukon and other inflowing rivers; winds and tides drive most of the mixing of water layers. The main current within Norton Sound is the Norton Sound Water Mass, a relatively weak inshore diversion of the Alaska Coastal Current (Hamazaki et al. 2005; Smith et al. 2017).

Measured current data is not available for Norton Sound offshore of Nome. Predicted current velocities based on tidal swings for Sedge Island are in the range of 0.5 knot on the ebb tide and 1.0 knot on the flood tide. Such values are likely representative of the Nome area. Sledge Island is approximately 20 nautical miles west of Nome.

Localized current velocities at the entrance to the Port of Nome vary depending on the wind and wave conditions. Local observations of current velocities of 0.5 to 0.8 knot have been reported. Stronger currents may be experienced by vessels navigating into and out of the port entrance channel when wave heights begin to exceed 4 to 5 ft and greater during storms.

In the summers of 2018 and 2019, Alaska Ocean Observing System (AOOS) deployed a Waverider Buoy to collect ocean current data off the coast of Nome in a water depth of 59.7 ft (National Data Bouy Center Station 46265). Average current velocities are in the range of 0.5 knots, with a maximum observed current speed of 2.3 knots, with a predominant direction from the west. Long-term measured current data is not available for Norton Sound offshore of Nome.

The USACE conducted a 3-D physical model study for the Nome Navigation Improvements project in 1999. As part of the study, wave-induced currents were evaluated using scaled measurements of current velocities in the model. Various wave heights, periods, wave directions, and still water levels were tested. Generally, current velocities were measured in the range of 0.4 to 1.3 ft per second at the entrance between the spur and main breakwaters. The highest measured current velocity of 4.4 ft per second was recorded in the model.

3.1.6.3 Stream Flow

The Snake River is the predominant drainage in the project vicinity. It discharges into Norton Sound through the Spit and the navigation channel between the causeway and the main breakwater. The approximate drainage area of the basin is 86 square miles, and the average daily discharge is less than 500 feet per second during the summer months. However, during breakup, the peak discharges can range between 2,000 and 3,000 cubic feet per second. Dry Creek and Bourbon Creek also drain into the project area and discharge through culverts beneath Seppala Drive into the back portion of the small boat harbor. Both creeks provide an average of less than 20 cubic feet per second discharge contribution to the system during average summer conditions. Similar to the Snake River, their flows increase during breakup with snowmelt conditions.

According to the Fourth National Climate Assessment (2017, Vol. 1), evidence for changes in maximum gauged streamflows is mixed, with a majority of locations having no significant trend. There is significance for seasonal changes in the timing of peak flows in interior Alaska, though increases in the absolute magnitude are not well evident in existing data.

Snake River discharge is diffused into the inner harbor areas and has only minor impacts on the inner harbor facilities. Outer harbor hydrodynamics are driven by wind and wave conditions. Snake River’s current impacts to the outer harbor and offshore environment are negligible as the flow is dispersed over an area much larger than the conveyance capacity of the river channel. The climate change-induced increases in river current are also expected to have a negligible impact on the Outer Basin and Deep Water Basin areas for the same reason.

The Snake River typically freezes up during the end of November each year. Earlier freeze-ups can occur during late September to any time in October, depending on seasonal weather patterns. The upstream portion of the river tends to freeze up first, while the downstream portion near the mouth at the navigation channel freezes last. Spring break-up of the river typically occurs in mid-May prior to the break-up of pack ice in Norton Sound. With increased river discharge in May, open leads begin to form in the navigation channel and tend to accelerate the pack ice breakup between the causeway and main breakwater. Little ice from the river itself flows down the channel to the mouth, and river ice jams have not been observed in the area.

3.1.7 Sedimentation

The predominant direction of littoral sediment movement along the shoreline at Nome is from west to east (see Appendix C [Hydraulic Design], Section 2). A volume of approximately 120,000 cubic yards per year (gross) of material transported along the shoreline was estimated. The net west-to-east transport volume of 60,000 cubic yards per year was calculated as the deposition of material on the west side of the causeway. A volume of 5,900 cubic yards of sediment per year was estimated to be contributed to the system by the Snake River. The majority of this material discharges into Norton Sound during spring break-up when ice cover is still present. River sediments are not expected to shoal and accumulate in the navigation channel.

As part of the 2006 navigation improvements project, three features were incorporated into the project for managing sediments: a west sediment trap, an east sediment trap, and an increased bridge span, and deepened gap in the causeway. USACE has performed maintenance dredging annually in the navigation channel that includes the Inner and Outer Basins. The average dredged volume from 2007-2018 has been 52,342 cubic yards with a minimum and maximum of 12,800 and 116,000 cubic yards, respectively (see Appendix C [Hydraulic Design], Section 2). Shoaling at the existing Nome harbor currently requires annual maintenance dredging. Dredge quantities in the current Outer Basin are small and usually changes depths by less than a foot annually in the Outer Basin (Appendix C, Section 5.4).

The east sediment trap portion of the project has not required annual maintenance but has been dredged on an as-needed/funds available basis. The west sediment trap has not been maintained and is not an active feature. Sediments from the channel maintenance dredging have been discharged on the beach east of the main breakwater since the late 2000’s. As a result, the steady buildup of the beach in front of the City of Nome has been observed along and in front of the rock seawall. This is an indication of the net sediment transport from west to east continuing after the completion of the navigation improvements project.

The approximate depth to where sediment transport is very small (depth of closure) is estimated to extend past -15 ft MLLW to about -30 ft to -32 ft MLLW, which is the depth that was estimated to extend beyond the depth of closure (USACE August 2018). A depth range of -15 ft to -30 ft MLLW was used to identify the potential nearshore placement area boundaries as an area where the dredged sediments would stay within the littoral zone sediment budget and have the potential of a beneficial use to migrate toward and build the beach.

3.1.8 Sea Level Change

USACE requires that planning studies and engineering designs consider alternatives that are formulated and evaluated for project impacts over a range of possible future rates of sea level change (SLC). Guidance for addressing SLC is in Engineer Regulation ER 1100-2-8162, a details of the SLC evaluation are presented in Appendix C (Hydraulic Design), Chapter 2.0. The evaluation considers three local mean SLC rate scenarios, “low,” “intermediate,” and “high” over the period of analysis. The “low” rate is the historic SLC based on local or nearby tide gauge data, if available. The “intermediate” and “high” rates are computed using the modified NRC Curve I and modified NRC Curve III, respectively, and applicable NRC equations using the current estimate of 1.7 mm/year for global mean sea level change (GMSL) change, as presented by the Intergovernmental Panel on Climate Change (IPCC 2007). These results are adjusted (added) by the estimated local rate of vertical land movement to calculate the “intermediate” and “high” GMSL for the project location. This “high” rate exceeds the upper bounds of the IPCC estimates from both 2001 and 2007 to accommodate the potential rapid loss of ice from Antarctica and Greenland, which causes global eustatic sea level rise. The three GMSL rise scenarios are shown in Figure 16.

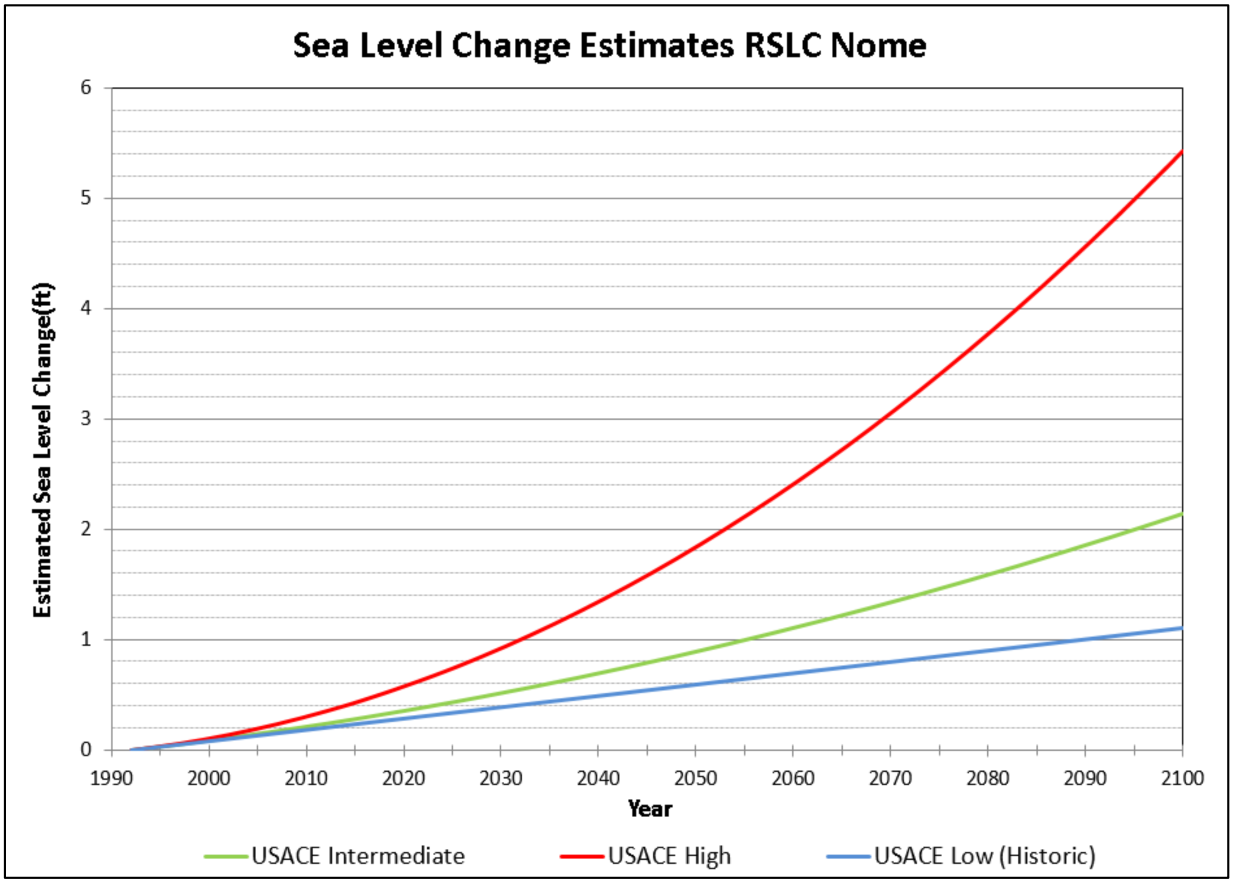

Figure 16. Scenarios of Global Mean Sea Level Change (based on updates to NRC 1987 equations

Three scenarios were identified to model sea level change at Nome, the GMSL rate, and the GMSL rate, including vertical land movement (VLM) was compared to the data available from Nome (see Figure 7). The local rate of VLM for Nome is -0.477 mm/yr ±0.368 mm/yr (NASA Jet Propulsion Laboratory, 2019) While the Nome station does not have the recommended 40 year period of record, it more accurately accounts for vertical land movement effects in the region which are not well represented by GMSL change. To best model sea level change at Nome, the Nome station data was used. The sea level change prediction used in the formulation of all alternatives is the Nome low/historic prediction (Table 4).

Table 4. Relative Sea Level Rise Prediction for a 50-year Project Life

Scenario	Low (Historic)	Intermediate (Curve I)	High (Curve III)
GSLC	+0.28 ft	+0.77 ft	+2.32 ft
GSLC+VLM	+0.36 ft	+0.85 ft	+2.40 ft
Nome	+0.51 ft	+1.00 ft	+2.55 ft

3.1.9 Storm Surge and Set Down

The northern coastline of Norton Sound is subject to storm surge increases in water surface elevation due to its exposure to a long southwest fetch. Storm-induced surges can produce short-term increases in water levels to an elevation considerably above mean tide levels. Typically, the major storm surges occur in the Norton Sound area during the fall months. Throughout its history, the City of Nome has experienced at least 18 occurrences of coastal flooding. With only two exceptions, the flooding occurred during the fall season. The "Great Bering Sea" storm of November 12, 1974, was the most severe to hit Nome' in the town's recorded history dating back to 1898 with surge rise of about 12 ft above MLLW and with wind-driven waves overtopping the City seawall that has a crest elevation of +18 ft MLLW.

The Engineer Research and Development Center (ERDC) published a study of predicted storm-induced water levels for the western coast of Alaska (USACE, 2009). The study presents the results of various numerical modeling techniques in the form of frequency of occurrence relationships for water levels at several selected communities in the region. For the Nome area, a 50-year storm surge water level residual of +8.9 ft MLLW was estimated.

Set-downs occur in the Nome area during periods of north winds and/or high-pressure atmospheric conditions. The result is a lowering of the water surface elevation below that of the astronomical tide level. Set-downs typically occur during the fall months when north winds are more prevalent. The duration of set-down water surface elevations varies. Typically, a 2 to 3-day period of low water is observed. The most extreme set-down recorded at Nome of -6.69 ft MLLW on November 11, 2005, was a rare event. More often, set-downs of -2 to -4 ft are observed. These are usually associated with north winds of approximately 20 knots and atmospheric pressures of 1,000 millibars and greater.

3.1.10 Water Quality

Water quality studies have not been carried out specifically at the Port of Nome Harbor. A study of general water quality in northern Norton Sound (Hood & Burrell 1974) found uniformly high dissolved oxygen concentrations, including in bottom waters, due to the mixing effects of storms. Concentrations of nutrients such as phosphorus and nitrogen were extremely high due to the influx of sediment and dissolved matter from the Yukon River into Norton Sound. Measurements of pH were within the slightly-basic norm (pH 7.7-8.1) for coastal marine waters.

Along the exposed Norton Sound coast at Nome, a significant water quality factor in the nearshore marine waters is suspended solids and the related parameter turbidity. Total suspended solids is simply a measure of the total mass of undissolved material (e.g., sediment, organic material, etc.) suspended in the water column, usually reported as milligrams per liter (mg/l). Turbidity is a measure of how light passing through the water is scattered and attenuated by the suspended material and is reported in nephelometric turbidity units (NTUs). Much of Norton Sound experiences high turbidity during the open water season, due to its shallow depth, energetic wave environment, high sediment load discharged by the Yukon and other rivers, and disturbance of the seafloor by gray whales, beluga whales, walruses, and other benthic feeders.

Turbidity measurements collected in association with the Bima gold dredging operations offshore of Nome showed that background turbidity could exceed 100 NTUs, and that sustained background turbidity could remain above 25 NTUs up to 74 % of the time during a two-week period (RJW 2013). As points of reference, the United States Environmental Protection Agency's (USEPA) basic maximum contaminant level (MCL) for turbidity in drinking water is 1.0 NTU (40 CFR 141.13), and the State of Alaska marine water quality standard for water supply and recreational uses is 25 NTUs (18 AAC 70).

Studies of metals concentrations in waters impacted by the Bima gold dredge showed that background levels at Nome were typical of unpolluted coastal waters (MMS 1990). Elevated concentrations of arsenic and other metals were reported in unfiltered samples from the dredge down-current plume, but not in filtered samples, suggesting that disturbance of high-metal sediment does not result in the release of dissolved-phase metals into the water column.

Salinity in Norton Sound is seasonally variable, especially in nearshore waters. Summer surface water salinities can be less than 20 practical salinity units (PSUs; equivalent to the concentration of sodium and chloride ions expressed in parts-per-thousand; the average salinity of oceanic seawater is 35.5 PSUs) due to the influx of fresh water from streams and subsurface seeps. Water column salinity increases to a maximum of 34 PSUs in winter, as fresh-water sources freeze, and sea ice formation concentrates dissolved ions in the unfrozen seawater. The formation of sea ice also leads to salinity stratification, as the water column is isolated from the mixing effect of wind. A layer of less-dense fresh water from Snake River pools on top of seawater within the Nome Outer Basin as it freezes over and the water column within the Inner Basin becomes entirely fresh over the course of the winter (Charlie Lean, personal communication, 2019). The stratification contributes to the estuarine character of the Outer Basin creating an earlier freeze and attracting saffron cod and their predators (Charlie Lean, personal communication, 2019).

3.1.11 Air Quality

Nome presumably enjoys good air quality because of the persistent winds off of the ocean, and a relatively low number of air pollutant sources. There is no established ambient air quality monitoring program at Nome, however, and no current existing data to compare with the National Ambient Air Quality Standards (NAAQS) established under the Clean Air Act (CAA). These air quality standards include concentration limits on the “criteria pollutants” carbon monoxide (CO), ozone (O_3), sulfur dioxide (SO_2), nitrogen oxides (NO_x), lead (Pb), and particulate matter (PM_{10}, $PM_{2.5}$).

The Snake River power plant, operated by the Nome Joint Utility System (NJUS), provides electric power to the City of Nome using five diesel generators. The power plant is the largest stationary source of air pollutants at Nome, and the only source requiring a Title V operating permit (Permit No. AQ0210TVP03) from the State of Alaska Air Permits Program (ADEC 2014). The power plant is located on the Snake River, a few hundred yards upstream of the Inner Basin. Residential and commercial buildings in Nome are heated primarily by heating oil, propane, and electricity.

Particulate matter, in the form of dust lofted from unpaved roads and trails, is a major air quality concern in Alaskan rural and smaller communities (ADEC 2018). The ADEC Air Quality Division has conducted repeated rural dust surveys, and Nome was one of numerous communities reporting people “highly affected by dust.” Most of Nome’s major streets and roads are paved, but, especially around the port, there are many unpaved roads and working areas.

Aggregate air emissions from vessels at the Port of Nome are unmonitored, but are expected to be highly seasonal (e.g., negligible during November through April), and highly variable depending on the number, type, and activity of vessels operating within and around the port at a given time during the ice-free season. Vessel operations in the inner harbor are limited primarily to gasoline-fueled and smaller diesel-fueled vessels; larger vessels moor at docks in the Outer Basin (the nearest distance from a causeway dock to a residential building is roughly 0.6 mile) or wait offshore.

3.1.12 Noise

The Port of Nome is currently a seasonally busy seaport. Sources of noise during the ice-free season include vessel engines and gear, as well as land-based sources such as vehicles, construction machinery, and the movement of cargo and equipment. The number of noise sources diminishes during the winter, although there is still activity in the industrial areas connected with the port. Most noise-generating activity at the port is at least several hundred yards from the nearest residences, although some housing, particularly in the Belmont Street area between Snake River and the inner harbor, is immediately adjacent to existing port-related industry.

3.1.13 Visual Resources

The Port of Nome is a regional center of marine services, transportation, and industry, and looks the part. As is often the case in remote Alaska communities, the high cost of transporting unserviceable or abandoned vessels, vehicles, or equipment off-site for recycling or proper disposal tends to result in an accumulation of such items. The existing rubblemound causeway has been a part of the Nome shoreline view-shed since 1985, and the existing rubblemound breakwater has been in place since 2006.

3.2 Biological Resources

The general region of influence (ROI) identified for biological resources in this study is the nearshore marine habitat of Norton Sound from Cape Nome to the higher lands just west of Cripple River, and extending seaward to the 60-ft depth profile (roughly two nautical miles offshore). This Norton Sound ROI encompasses the project construction area at Nome within its setting of similar exposed, high-energy coastline at the north entrance of Norton Sound; the presumptive source of rock for the project at a Cape Nome quarry; and the marine interface of several anadromous streams discharging along that coast (Figure 17).

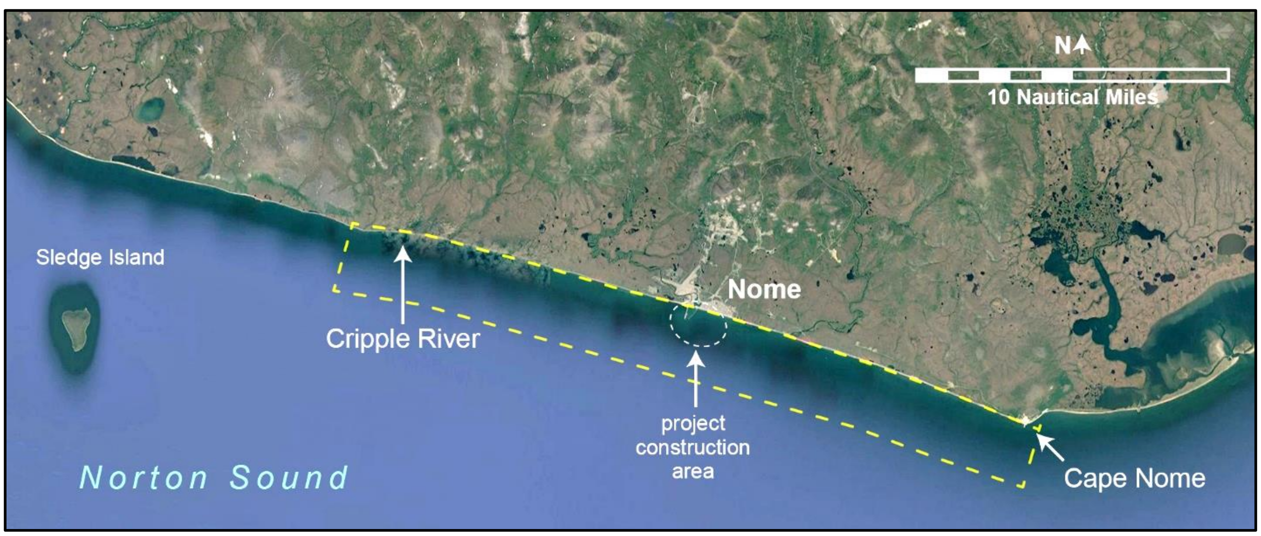

Figure 17. Norton Sound ROI for biological resources.

An additional ROI identified is the presumptive route of project vessels transiting between Anchorage and Nome (Figure 18); this ROI is primarily intended to assess potential effects from project vessels on protected species beyond Norton Sound. The base image of Figure 18 is a screen-shot from MarineTraffic.com showing the transit lines (dark blue) of all 2017 tugboat traffic within that view. The yellow dotted line traces a "most traveled" direct route from Anchorage to Nome, passing through Cook Inlet, hugging the protected south coast of the Alaska Peninsula, and then turning north into the Bering Sea at Unimak Pass.

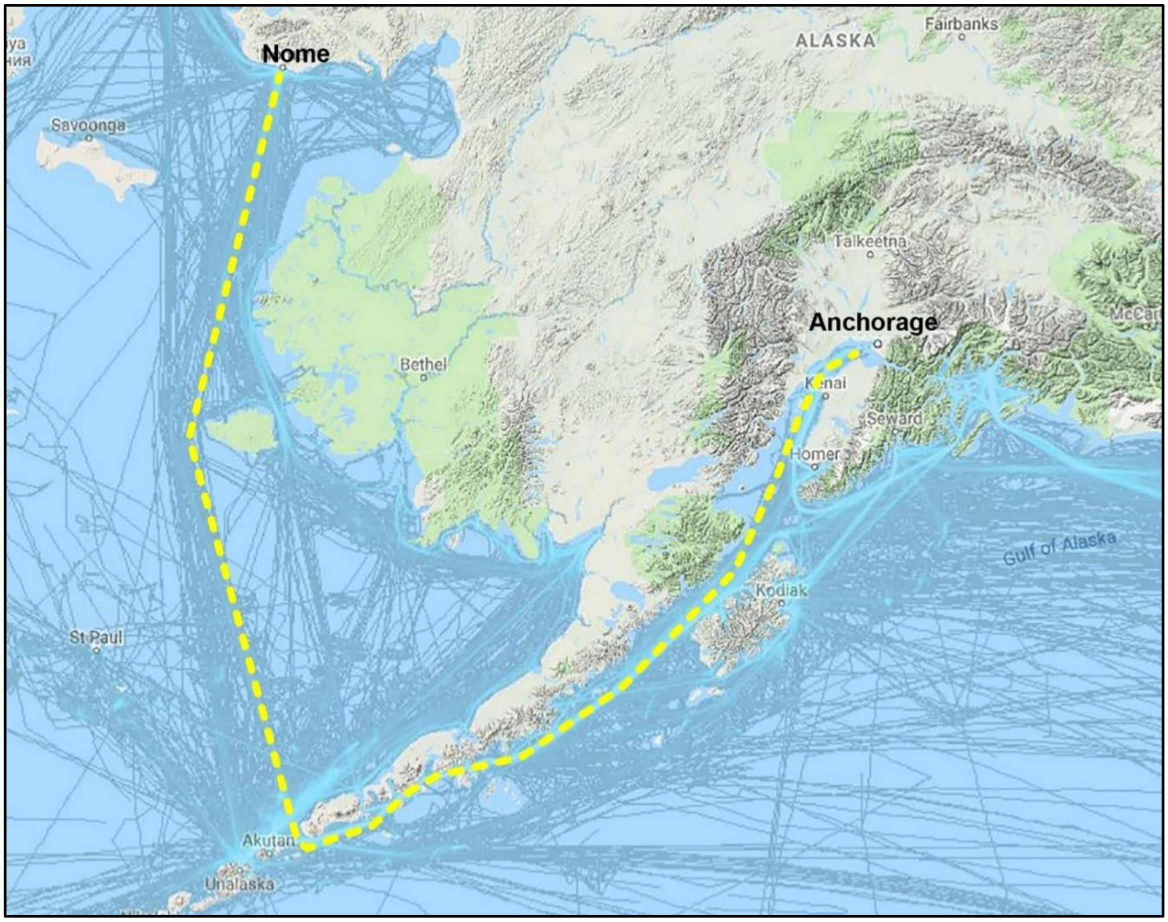

Figure 18. Transit ROI for Protect Species

3.2.1 Habitat and Wildlife

3.2.1.1 Primary Productivity

In the northern Bering Sea, the conversion of solar energy into biochemical energy (i.e., primary production) is carried out mostly by microscopic algae, or phytoplankton. Primary production is highly seasonal in this region and closely linked to sea ice cover and thickness. The spring retreat of sea ice exposes more open sea to more light from the lengthening days, triggering a spring phytoplankton bloom. Phytoplankton blooms may also occur under sea ice that is relatively thin and not covered by snow. During the formation of sea ice in the fall, phytoplankton are sequestered in brine channels within the ice and can survive the winter to be released back into the water column as the ice melts in the spring. Phytoplankton are consumed by zooplankton, which in turn feed many small and juvenile fish. Excess phytoplankton falls to the seafloor as organic matter and feeds organisms such as crabs and mollusks (Oceana and Kawerak, Inc. 2014; Smith et al. 2017).

3.2.1.2 Benthic Habitat

The benthic (i.e., seafloor) ecology of Norton Sound is dominated by invertebrates such as sea stars and crab instead of demersal fish (i.e., fish living on or near the seafloor) as is typical elsewhere in the Bering Sea. Norton Sound epibenthic (i.e., living on the seafloor surface) and demersal fauna have been monitored triennially by trawl studies since 1976 by the National Marine Fisheries Service (NMFS) and the Alaska Department of Fish and Game (ADFG). A retrospective analysis (Hamazaki et al. 2005) of these trawl studies from 1976 to 2002 identified the major groups of organisms collected (Table 5) and their relative abundance.

Table 5. Norton Sound epibenthic and demersal species identified during NMFS/ADFG trawl surveys (adapted from Hamazaki et al. 2005).

Group	No. of Identified Species	Major Species (common names)	2002 Catch-per-unit-effort, (kg/km^2)
Sea Stars	16	Northern Pacific seastar, black-spined star, mottled star	6,773
Crabs	10	Helmet crab, red king crab, blue king crab	145
Snails	49	Neptune whelk, left-handed whelk, tritonid nudibranch	161
Tunicates	20	‘Sea potato’ tunicate, ‘sea peach’ tunicate, spiny-headed tunicate	159
Flatfish	9	Starry flounder, yellowfin sole, Pacific halibut	484
Cods	5	Saffron cod, walleye pollock, Pacific cod	396
Sculpins	28	Plain sculpin, warty sculpin, Arctic sculpin	131

(kg/km2) = kilograms per kilometer square

Similar studies in Norton Sound have found sea stars and related organisms (echinoderms such as basket stars and sea urchins) to make up about 80 % of the invertebrate biomass. The northern Pacific seastar (*Asterias amurensis*) is indigenous to the Asian Pacific coast and is considered an invasive species in Alaskan waters. Other epibenthic invertebrates present include amphipods, shrimp, and soft corals

(RJW 2013). Benthic invertebrates are an important food source for commercially-important crab species, fishes, and marine mammals.

Red king crab (*Paralithodes camtschaticus*) is an essential Norton Sound benthic invertebrate for human use. The Norton Sound red king crab stock appears to be isolated from other Bering Sea stocks of this species; it lives in relatively shallow water and is confined under sea ice for five to six months each year. Adult and sub-adult crabs migrate into coastal waters near Nome in late fall and winter, then return to deeper waters when nearshore ice breaks up in spring, and coastal water temperatures rise and, salinities decrease (RJW 2013).

Organisms living under the surface of marine sediment of western Norton Sound include polychaete worms, sand dollars, and mollusks such as clams and cockles. These mollusks are important prey for sea stars and walrus, as well as crab and flatfish (Fukuyama and Oliver 1985, RJW 2013).

Six species of demersal fish have made up the bulk of fishes caught in Norton Sound benthic trawl studies: saffron cod, Arctic cod, starry flounder, yellowfin sole, Alaska plaice, and plain sculpin. Saffron cod is a vital subsistence resource, harvested mainly in winter, and also a major prey species for marine mammals. Arctic cod tend to be distributed farther offshore than saffron cod, but do inhabit shallower nearshore waters in winter. Yellowfin sole display a seasonal distribution opposite of the cod species, moving into inshore waters to spawn during spring and summer, and returning to deeper offshore waters in the fall and winter. Juvenile yellowfin sole remains in shallow, nearshore areas for several years (RJW 2013).

USACE conducted a limited bottom-trawl and crab pot survey in August 2014 at three sites offshore of Nome beyond the 3-nautical-mile limit. The catch from that survey (Figure 19) was comparable to the NMFS and ADFG survey areas (see Figure 17).

Figure 19. Representative photos of sea stars, crab, soft coral, sculpins, and Pacific cod collected during a USACE bottom-trawl and crab pot survey performed in August 2014.

The inshore benthic environment (within about one nautical mile) at Nome is highly dynamic, subject to frequent disruption from currents, storms, ice, and gold-dredging. Littoral transport moves such volumes of fine sediment along the shoreline that Nome Harbor must be dredged annually. During ice-free months, frequent storms can cause substantial redistribution of bottom sediments and disruption of benthic habitat at depths of 60 ft or greater (Jewett 2013). Shore-fast ice extends to the seabed within the 8- to 10-ft depth contour, and the movement of this nearshore ice during spring break up scours bottom sediments out to roughly the 20-ft depth contour (Charlie Lean, personal communication, 2019). Figure 20 shows soundings in ft and contour lines). The recurring disruption of benthic sediments in this zone limits its use primarily to organisms adapted to loose, mobile substrates, such as polychaetes and amphipods. The frequency and severity of benthic disruption decreases farther offshore with increasing water depth. Beginning at approximately the 30-ft depth contour, littoral transport of fine sediments tapers off, and the seafloor becomes a mosaic of sand and cobble habitats, periodically re-arranged by stronger storm surges. Where left undisturbed for several years, the cobble becomes encrusted with bryozoans and other marine organisms, creating vital “settling” habitat for juvenile red king crab (Stevens and Swiney 2004; RJW 2013). Cobble-sand benthic habitat disrupted by storm surge or human activity (e.g., gold-dredging) may take 5 to 6 undisturbed years to regain biological function and productivity (Jewett 2013; Charlie Lean, personal communication, 2019).

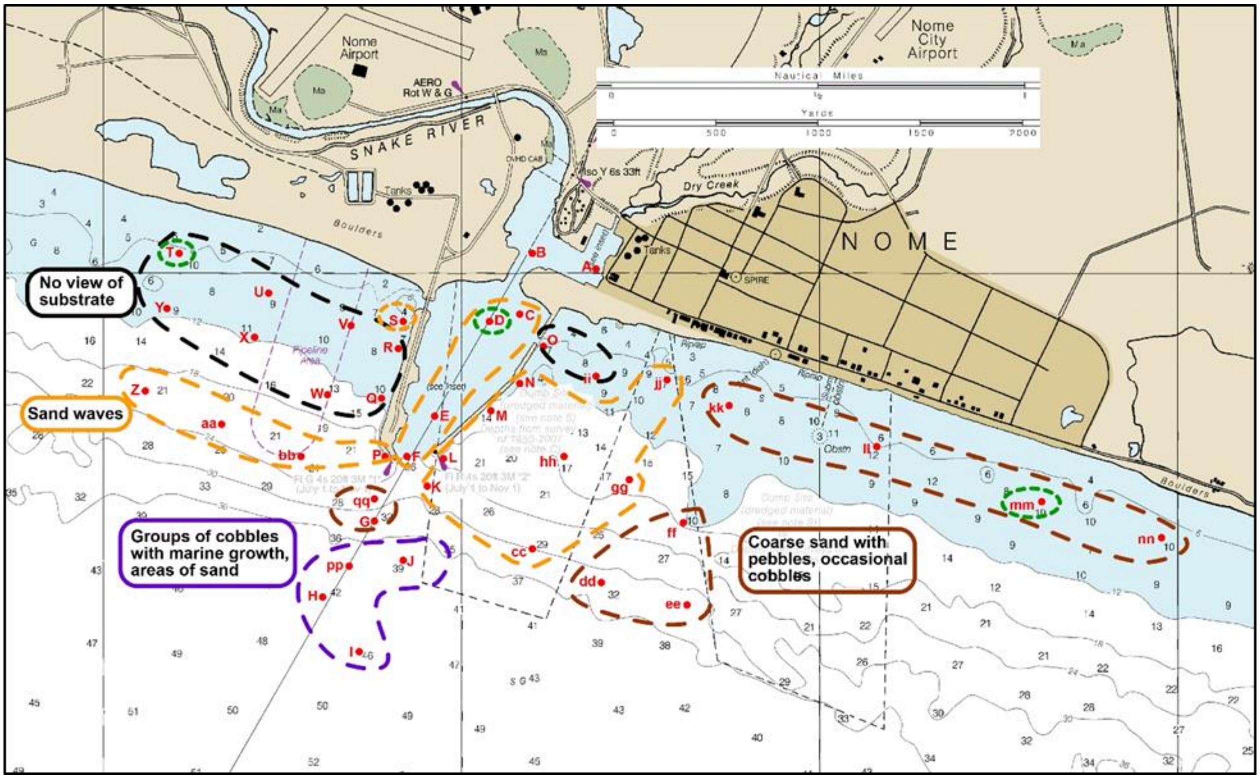

Figure 20. Conceptual groupings of substrate types observed using a drop-camera 7-8 August

Note: The red dots with alphabetical designations indicate the 43 individual observation points (base image is adapted from NOAA Chart 16206; soundings are in ft).

To better characterize the benthic substrate and habitat in the proposed project area, the USACE performed a preliminary video survey in August 2018, using a drop-camera at 43 locations (see Figure 20). Most points within and to the immediate east and west of the Outer Basin showed waves of fine sand (Figure 20 and Figure 21). Although sea conditions during the survey were very calm, with little discernable swell at the surface, the videos show a steady subsurface wave action visibly reworking the sand waves and re-suspending fine sediments. The water column in a broad area to the west of the causeway was so turbid that the seafloor could not be viewed by the camera resting just a few inches off the bottom (Figure 20 and Figure 21).

Areas of coarser sand, sometimes with pebbles and cobbles, were noted to the east of the breakwater, and is a known scour area off the end of the causeway (Figure 20 and Figure 21), but not west of the causeway. Given the general west-to-east littoral transport along the coastline at Nome, these coarse deposits may result from changes to sediment transport caused by the causeway and breakwater structures. The gravel deposits may also be due to dredged material from 2006 and earlier navigation improvements that were disposed of in this area (Charlie Lean, personal communication, 2019).

Discontinuous areas of cobbles and boulders encrusted with marine life (tentatively identified from the videos as sponges, bryozoans, small barnacles, etc.) were found at points off the end of the current causeway, roughly 3,200 to 6,000 ft from the shoreline in water depths of 40 to 50 ft. These points are in the overall footprint of an extended causeway. Swaths of sand and gravel separated the groups of cobbles.

Reduced visibility at most locations was due to suspended material and a massive green cast from phytoplankton (Figure 21). At many locations, material in the water column appeared to be planktonic or free-swimming organisms, judging by the size and movement of the particles. Incidental sightings of larger marine organisms noted on the drop-camera videos included several fish, probably saffron cod, at points ee and ff (Figure 21 and Figure 20); several possible small squid at point gg; a sea jelly (probably *Aurelia* sp.) at point cc; unidentified 5-limbed sea stars at points aa and cc; and a possible marine worm casting on the sand surface at point M. At three widely-spaced points, the drop-camera encountered large clumps of unidentified marine plants (points D, T, and mm in Figure 20; photo in Figure 21). The orientation and motion of the plants in the videos suggested that they were rooted in the substrate, but this could not be confirmed.

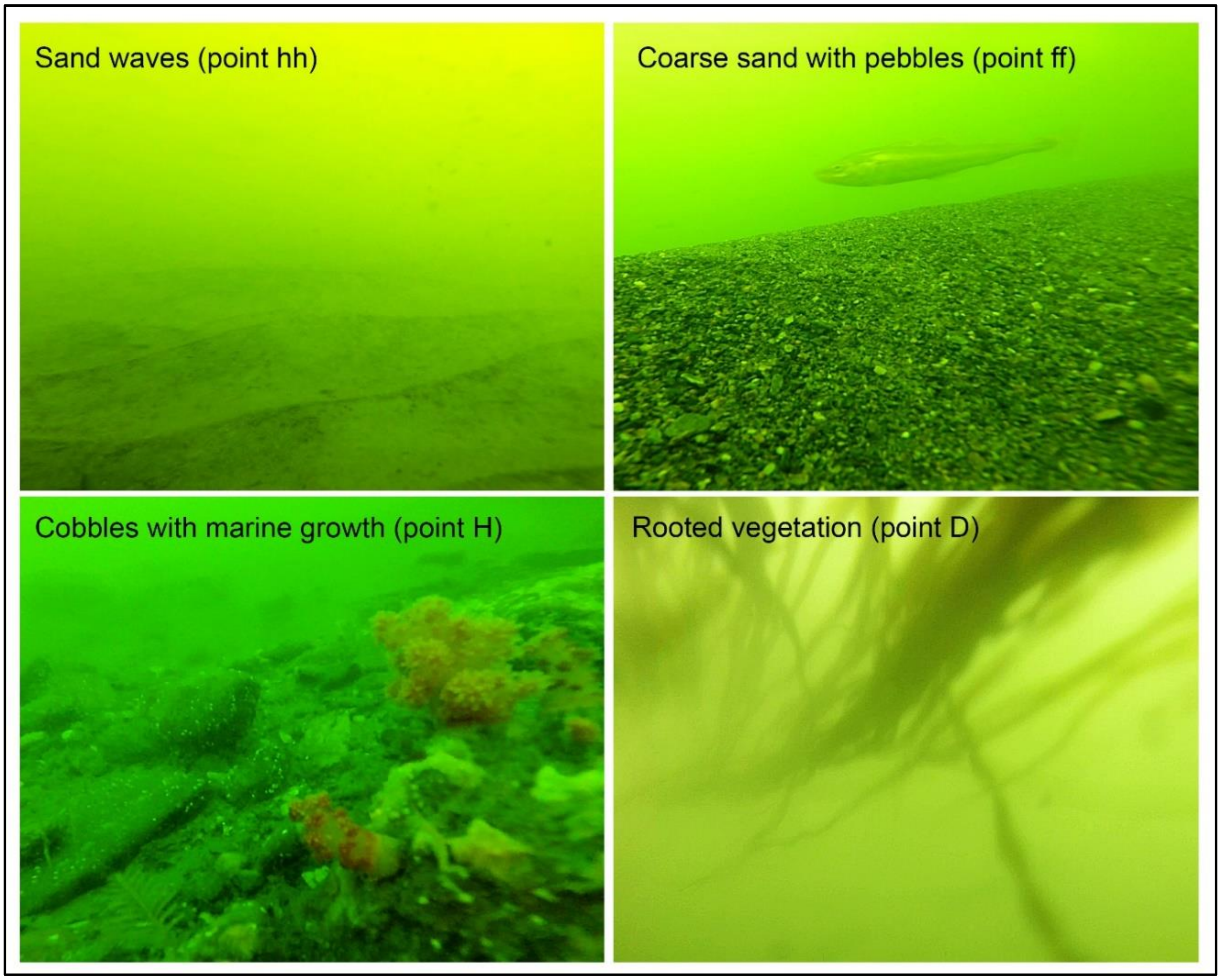

Figure 21. Representative still photos from the 7-8 August 2018 drop-camera video survey, showing the different types of substrate and seafloor features observed.

In a follow-up survey performed in May 2019, USACE biologists used a towed underwater video camera to record transects along the seafloor within the proposed footprint of new construction (using the maximum-extent footprint of Alternative 8b; Figure 22). The results were consistent with the habitat patterns observed during the 2018 drop-camera survey: a patchwork of boulders and cobbles interspersed with areas of sand (Floyd 2019a). The USACE viewed and logged the video of each transect at 30-second intervals to estimate the percent of hard-bottom habitat along each transect (Table 6; Floyd 2019b):

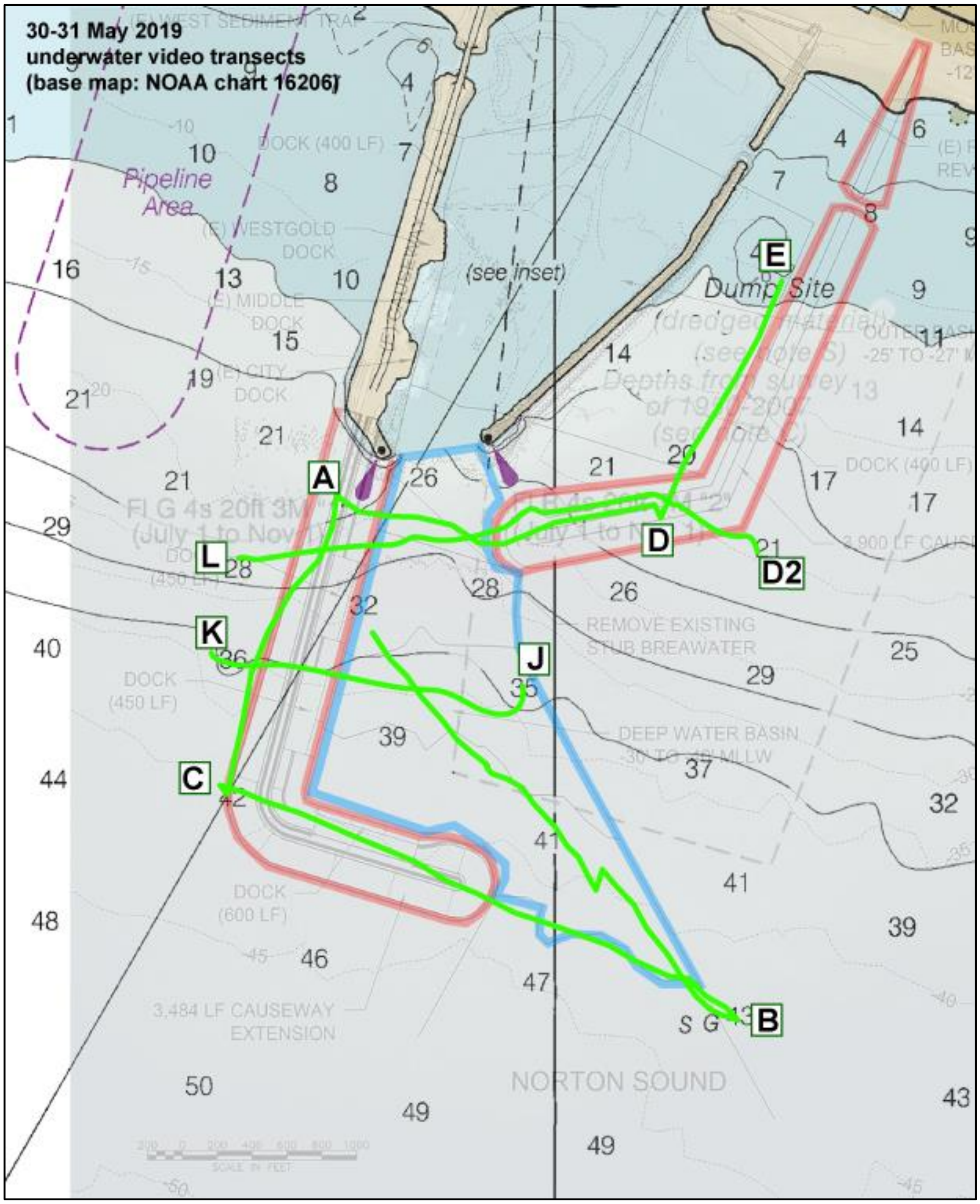

Figure 22. Video transect lines within the project footprint, 30-31 May 2019.

Table 6. Estimated Percent Hard-Bottom Habitat Observed Along 30-31 May Video

Video Transect	Percent (%) Cover of Cobbles/Boulders along Transect
Transect A-to-B	41.7
Transect B-to-C	32.9
Transect C-to-A	8.6
Transect A-to-D2	2.3
Transect D-to-E	0.0
Transect J-to-K	14.8

Note: See Figure 22. Video transect lines within the project footprint, 30-31 May 2019.

Transect L-to-D (see Figure 22) was not included in this estimate, as it would have been mostly duplicative of Transect A-to-D2. All hard-bottom habitat was included in the estimate, whether or not it hosted marine growth; the amount of growth observed on cobbles and boulders varied widely. It is unknown whether this reflects the suitability of a particular cobble or boulder or some poorly understood succession cycle of epilithic organisms within such a habitat.

The existing rubble mound causeway and breakwater at Nome represent another type of substrate within the project area that is uncommon in the Nome area: vertical rocky surfaces. Annual scouring by sea ice and a minimal tidal range presumably severely limits the extent to which intertidal marine organisms can exploit the rock surfaces. Still, the growth of several marine algae species, including *Fucus* (a.k.a., rockweed), can be seen at numerous locations on armor stone awash or just under the water surface (Figure 23). Herring are known to spawn on these patches of *Fucus* (Charlie Lean, personal communication, 2019). Small barnacles are also widespread on the rock surfaces. Mussels grow at depth on the rock; their shells are abundant on the beach to the east of the causeway. Drop-camera videos taken on 31 May 2019 along the causeway and breakwater showed diverse communities of marine algae, invertebrates, and fish occupying the riprap at depth, especially along the seaward sides. Fish species included white-spotted greenling, wolf fish (Figure 24), and large sculpin (Floyd 2019a). The ice environment at Nome requires rubble mound structures to be surfaced with unusually large armor rock, the arrangement of which creates correspondingly large voids and channels within the structure; these are potentially useful microenvironments that organisms may exploit in unknown ways.

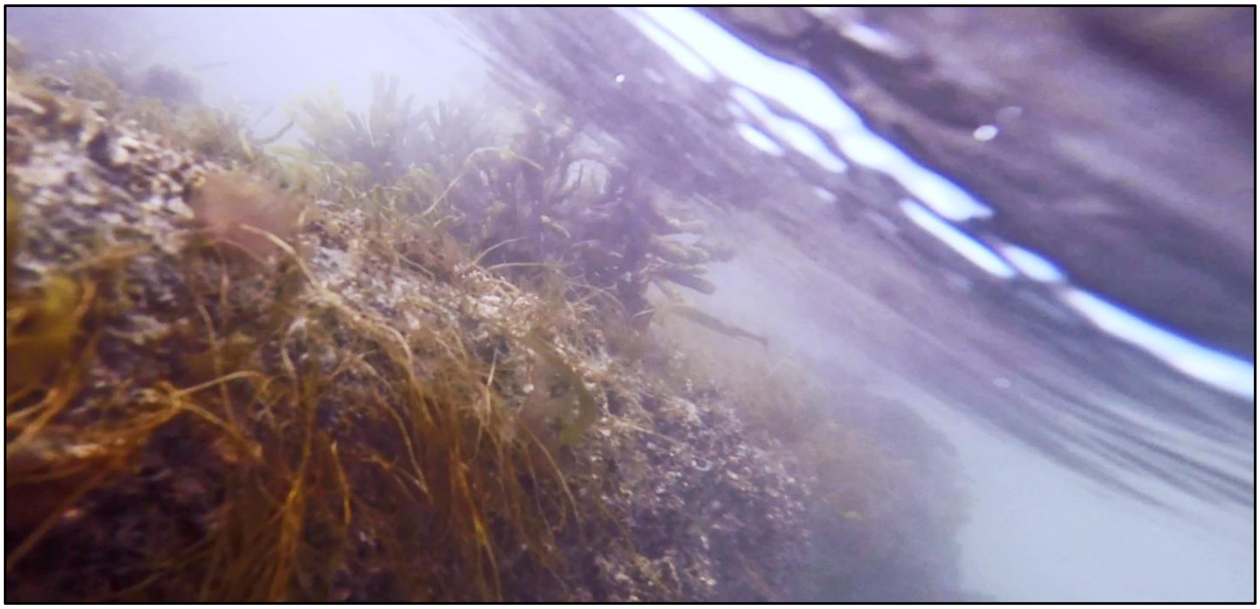

Figure 23. Fucus, other marine algae, and barnacles are growing on causeway armor stone below the water surface (8 August 2018).

Figure 24. Large wolf fish observed on the seaward side of the breakwater (31 May 2019).

3.2.1.3 Pelagic Fishes

Major non-benthic marine species include ocean-run Pacific salmon, of which all five species are present in Norton Sound. Chum salmon and pink salmon are the most abundant species in this area, while coho, chinook, and sockeye are much less common or widespread. The ADFG identifies six anadromous streams that discharge into Norton Sound within the ROI: from west to east, Cripple River, Penny River, Snake River, Dry Creek, Nome River, and Hastings Creek (ADFG 2019a). Snake River and

Dry Creek flow directly into the Nome Inner Harbor; the next closest is Nome River, whose mouth is about 4 miles southeast of the harbor. Salmon and their habitat are discussed in more detail below in Section 3.2.5, Essential Fish Habitat.

In general, adult salmon in-migrations in Norton Sound occur from mid-June through August (RJW 2013). At Snake River, adult chum and pink salmon return from about 4 to 25 July (Figure 25), while sockeye salmon return from 20 July to 10 August. Coho in-migrations are more variable but happen in a three-week window between 5 August and 10 September. Juvenile salmon exit the Snake River in the second and third week of June (Lean 2019).

Figure 25. Shoals of pink salmon entering Nome inner harbor from Norton Sound (undated photo provided by James Menard, ADFG).

Dolly Varden char (*Salvelinus malma*) is another anadromous salmonid, widespread and abundant in the waterways surrounding Nome. Dolly Varden spawn in the autumn in freshwater streams. Juveniles spend 2 to 4 years in freshwater, after which period some migrate to the marine environment to feed during the summer, then return to freshwater to spawn and spend the winter. Unlike Pacific salmon, Dolly Varden may spawn multiple times during their lives, though individuals rarely survive to spawn more than three times. This species is an important subsistence fish in northwest Alaska, and a popular sport fish (ADFG 2019b).

Pacific herring appear along the Bering Sea coast immediately after ice breakup in mid-May to early June, with peak spawning occurring during the first half of June. Spawning is primarily in intertidal and shallow subtidal areas, with rockweed (*Fucus* sp.), eelgrass, or bare rock serving as the substrate. The major herring spawning areas are in the eastern and southern parts of Norton Sound, where suitable spawning substrate is more available. Still, herring can be seen spawning along the stone causeway and breakwater at Nome in early June. Pacific herring migrate back to deeper waters in mid-September (ADFG 2012; RJW 2013).

Capelin, sand lance, and smelt are abundant, widespread forage fishes that play a crucial role in Bering Sea food webs. They serve as prey species for larger fish, birds, and marine mammals Capelin and sand lance spawn in sandy intertidal habitats, while smelt prefer aquatic plants and rocky substrates (RJW 2013; Smith et al. 2017); capelin in the Nome area spawn in mid-June (ADFG 2012).

3.2.1.4 Coastal Birds

The industrial setting surrounding the port and the adjacent well-traveled beaches offer limited habitat for birds. Glaucous-winged gulls, mew gulls, and common ravens forage along the beaches and roost on harbor infrastructure. Seabirds such as black-legged kittiwakes, horned puffins, tufted puffins, common murres, thick-billed murres, and pelagic cormorants nest on coastal bluffs outside the ROI but may be seen feeding offshore of Nome (Figure 26).

Red-throated loons, yellow-billed loons, long-tailed ducks, and phalaropes nest in the wetlands just inland from the coast but often feed in marine waters. On less disturbed beaches, Arctic and Aleutian terns may nest directly on the sand, while common eiders use vegetated areas on upper beaches (ADFG 2012; Smith et al. 2017).

Figure 26. Black-legged kittiwakes are roosting on the Nome causeway armor rock (August 2018).

No significant bird concentration areas exist within the ROI, although peregrine falcons and common ravens are known to nest on the rocky bluffs at the Cape Nome quarry (ADFG 2012, ADEC 2018). Just east of Cape Nome, roughly 14 miles east-southeast of the harbor, Safety Sound and its associated barrier islands and wetlands are important concentration areas for breeding Aleutian terns, common and king eiders, long-tailed ducks, and other waterfowl. Sledge Island, about 23 miles west-southwest of Nome and over five miles off the mainland coast, hosts small breeding colonies of black-legged kittiwakes, common and thick-billed murres, horned puffins, and parakeet auklets (ADEC 2018).

3.2.1.5 Marine Mammals

This is a general natural history discussion of marine mammals and their habitat and distribution near Nome. Several of these marine mammals are listed under the Endangered Species Act and are discussed in that context in Section 3.2.2.1. All of these marine mammals are protected under the Marine Mammal Protection Act, addressed in Section 3.2.2.2.

Several species of seals, walrus, and whales make notable use of Norton Sound for at least a portion of the year, their seasonal distribution tied to the advance and retreat of sea ice. Ringed, bearded, spotted, and ribbon seals are collectively known as “ice seals” due to their associations with sea ice. Ringed seals are the most widespread and numerous of the ice seals. They are primarily associated with shorefast ice, whereas the other ice seals generally prefer moving ice. Ringed seals can create and maintain breathing holes in thick winter ice, and may build a den in the snow; pupping occurs in late winter or early spring. Near Nome, ringed seals are often seen using open water offshore from Cape Nome and Safety Sound in winter and spring. Some ringed seals follow the ice pack north as it retreats, but others remain in Norton Sound all summer, feeding on salmon and other fish at the mouths of rivers like the Cripple, Penny, and Nome Rivers. Juvenile seals are often seen resting on beaches (Oceana and Kawerak, Inc. 2014).

Bearded seals prefer moving ice and open water over relatively shallow seafloors. They feed primarily at or near the seabed, on benthic invertebrates and demersal fish. Like the ringed seals, bearded seals congregate at the open water found near Cape Nome and Sledge Island in winter and spring. Juvenile bearded seals may remain in open water during the summer, feeding in lagoons and rivers, but older individuals migrate north with the retreating pack ice. Bearded seals are a particularly important subsistence species (Oceana and Kawerak, Inc. 2014).

Spotted seals prefer the outmost margins of winter sea ice, so their winter range is typically south of Norton Sound. They are generally widespread through the Bering Sea and Norton Sound in summer and early fall and may haul out onto beaches in large groups. Most summer and fall concentrations of Norton Sound spotted seals are in the eastern portion of the Sound, where herring and small cod are more abundant. Spotted seals are reportedly more sensitive to human disturbances than other seals or walruses, and have been displaced from some haulout and feeding areas due to such disturbance. However, spotted seals are regularly seen within Nome harbor, especially before or after the busy summer season, sometimes hauled out on the beach (Figure 27) or breakwater (Charlie Lean, personal communication, 2019). The existing Outer Basin at the Port of Nome, since construction of the new entrance channel and east breakwater in 2006, has become the new river mouth and a sort of artificial lagoon of the Snake River. Seals and other marine mammals tend to congregate there, especially in the autumn (Kawerak, Inc., 2017).

Figure 27. Juvenile spotted seal resting on a beach inside the inner harbor (June 2015).

Ribbon seals are relatively uncommon and seen only occasionally by Nome-area hunters. Like spotted seals, they spend winters along the southern edge of Bering Sea ice. Ribbon seals spend most of their time in open water away from land and rarely haul out to shore. Large groups of ribbon seals have been seen offshore of Cape Nome in late spring and early fall (Oceana and Kawerak, Inc. 2014).

Pacific walrus prefer access to open water and concentrate in winter in Bering Sea areas where winds and currents create dependable leads and polynyas. Most walruses follow the springtime retreating ice edge back into the Chukchi Sea, but some adult male walrus remain in the Bering Sea. An area of late lingering ice in eastern Norton

Sound is known as a spring concentration area for male walrus, where they feed on mollusks and shrimp along the seafloor. Near Nome, walrus typically stay well offshore during migration; Nome-area hunters may have to travel up to 50 miles from shore to find walrus (Oceana and Kawerak, Inc. 2014). Individual walrus, however, have been spotted near Nome harbor, sometimes hauled out onto the breakwater (Charlie Lean, personal communication, 2019). Walruses are an important subsistence species throughout the Bering Strait region.

Beluga whales concentrating in Norton Sound belong to the eastern Bering Sea stock, one of five stocks found in Alaskan waters. Belugas are small, toothed whales that feed in shallow coastal waters and at the mouths of rivers, and are generally found in herds that range in size from a handful of individuals to hundreds. Beluga whales use Norton Sound during the entire open-water season, but not typically in the winter, due to the extensive ice cover. During the spring and summer, beluga whales in Norton Sound tend to concentrate in the eastern half of the Sound (Oceana and Kawerak, Inc. 2014), but the whales may be seen migrating in large numbers close to the shoreline near Nome in late autumn (ADFG 2012). Beluga whales have been occasionally spotted in the Nome Outer Basin during the fall migration (Charlie Lean, personal communication, 2019).

Gray whales may be seen feeding in Norton Sound, including offshore of Nome, in the spring and summer, but do not appear to concentrate in the Sound (ADFG 2012). According to Ms. Gay Sheffield, a long-time Nome resident and marine biologist affiliated with the University of Alaska and the Alaska Sea Grant Marine Advisory Program, Steller sea lions forage in Norton Sound and farther north. Sea lions haul out in small numbers at Sledge Island, about 22 miles west of Nome (Oceana and Kawerak 2014).

3.2.1.6 Inland Setting

The Norton Sound shoreline at Nome and for 10 to13 miles on either side consists primarily of exposed sandy beach. In NOAA's Environmental Sensitivity Index (ESI) for northwest arctic Alaska (NOAA 2002), the roughly 25-mile coastline within the project Norton Sound ROI is designated almost entirely as “mixed sand and gravel beaches” (ESI shoreline habitat Type 5). This habitat type is described as a “moderately sloping beach (8 to15 degrees) composed of a mixture of sand and at least 20 % gravel.” A few small pockets of sheltered tidal flat or salt marsh habitat are designated at the mouths of the Cripple, Penny, and Nome Rivers (Figure 28).

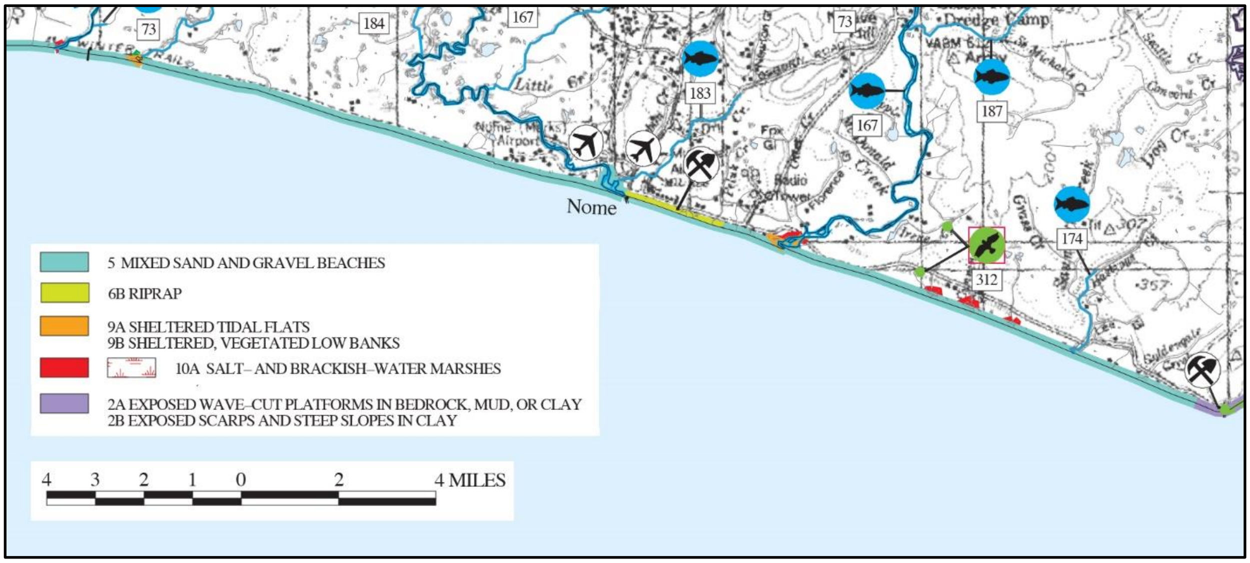

Figure 28. ESI shoreline habitat types (adapted from NOAA 2002).

Where the beach is broad enough, typical upper-beach vegetation such as beach wildrye and beach greens are found (Figure 29). The beach accreting immediately to the west of the causeway is sometimes mined for sand.

Figure 29. Beach wildrye and beach greens growing on the upper beach immediately east of the Nome breakwater (August 2018).

Immediately inland of the beach at Nome is the extensively developed and modified port area and city center (Figure 30). A rubblemound seawall extends for approximately 2,600 yards along the Nome waterfront. The Nome-Council Road provides ready public access to beaches east of Nome, but no similar road runs along the Norton Sound coast to the west of Nome. Lands within and surrounding Nome that are not filled and developed are almost entirely freshwater and estuarine wetlands (Figure 31), although these wetlands are highly modified in some locations by past gold-dredging activities.

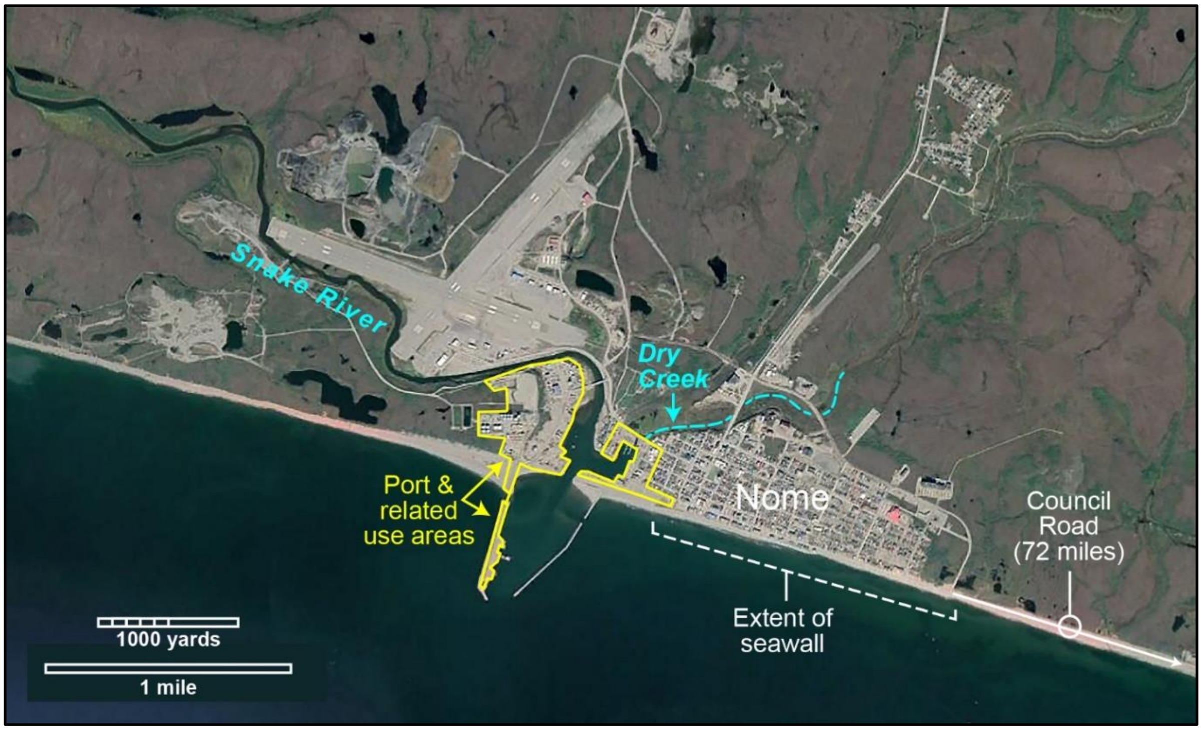

Figure 30. Port of Nome and its surrounding uplands (Satellite image: August 2017).

Figure 31. Screen-shot from the USFWS National Wetlands Inventory website (NWI 2019).

3.2.2 Protected Species

3.2.2.1 Endangered Species Act

Jurisdiction under the Endangered Species Act (ESA) of 1973 is divided by species between the USFWS and the NMFS. Through informal consultation with the USFWS and the NMFS (USACE 2017a, USACE 2017b), the USACE has identified the ESA-listed species that may be present in the project ROIs, or along the presumptive route of project construction-related vessels traveling between Anchorage, Alaska, and Nome (Table 7).

Table 7. ESA-Listed Species Potentially Affected by the Proposed Action.

Species	Listed Population	ESA Status	Agency Jurisdiction	ROI in which species is present	Critical Habitat in ROI?
Ringed seal, *Pusa hisipida*	Arctic DPS	Threatened	NMFS	Norton Sound	Proposed
Bearded seal, *Erignathus barbatus*	Beringia DPS	Threatened	NMFS	Norton Sound	No
Steller sea lion, *Eumetopias jubatus*	Western DPS	Endangered	NMFS	Norton Sound & Transit	**Yes**
Bowhead whale, *Balaena mysticetus*	All	Endangered	NMFS	Norton Sound	No
Humpback whale, *Megaptera novaeangliae*	W. Pacific DPS	Endangered	NMFS	Norton Sound & Transit	No
	Mexico DPS	Threatened			
N. Pacific right whale, *Eubalaena japonica*	All	Endangered	NMFS	Norton Sound & Transit	**Yes**
Gray whale, *Eschrichtius robustus*	Western North Pacific DPS	Endangered	NMFS	Norton Sound & Transit	No
Sperm whale, *Physeter macrocephalus*	All	Endangered	NMFS	Transit	No
Fin whale, *Balaenoptera physalus*	All	Endangered	NMFS	Transit	No
Blue whale *Balaenoptera musculus*	All	Endangered	NMFS	Transit	No
Beluga whale, *Delphinapterus leucas*	Cook Inlet DPS	Endangered	NMFS	Transit	**Yes**
Polar bear, *Ursus maritimus*	All	Threatened	USFWS	Norton Sound	**Yes**
Spectacled eider, *Somateria fischeri*	All	Threatened	USFWS	Norton Sound	No
Steller's eider, *Polysticta stelleri*	All	Threatened	USFWS	Norton Sound	No
Northern sea otter, *Enhydra lutris kenyoni*	Southwestern Alaska DPS	Threatened	USFWS	Transit	No
Short-tailed albatross, *Phoebastria albatrus*	All	Endangered	USFWS	Transit	No

Note: DPS=Distinct Population Segment

When a species is listed under the ESA, the responsible agency is required to determine whether there are areas containing physical or biological features that are essential to support the recovery of that species and designate such areas and features as “critical habitat” (CH). For some listed species, insufficient information or other factors may delay or forestall the designation of CH. Designated CH that is present in the project area is described by species in the section below.

The ADFG is required under state law (AS 16.20.190) to maintain a list of endangered species in Alaska. The State of Alaska endangered species list currently includes:

- Blue whale (*Balaenoptera musculus)*
- Humpback whale (*Megaptera novaeangliae)*
- Right whale *(Eubalaena japonica)*
- Short-tailed albatross (*Phoebastria albatrus)*
- Eskimo curlew (*Numenius borealis)*

The three whale species designated as endangered by the State of Alaska are duplicative of ESA-listed species (see Table 7). The Eskimo curlew is quite possibly extinct; the last confirmed sighting was in 1987. This species’ former range did not include the Seward Peninsula or Bering Sea, and it will not be discussed further here.

<u>Ringed Seal</u>
The ringed seal is the smallest and most common Arctic seal; they are found in all seasonally ice-covered seas of the Northern Hemisphere. There is one recognized stock of ringed seals, the Arctic stock, found in U.S. waters; the population of this stock is estimated at over 300,000 individuals. The Arctic ringed seal was listed as threatened in 2012 due to anticipated long-term alteration of their sea ice habitat. The District Court of Alaska vacated this listing; the NMFS has appealed that ruling, and the species ESA status was eventually restored. CH was proposed in December 2014 in conjunction with the listing of arctic ringed seals; the rule has not been finalized and may be revised. The CH description proposed in 2014 encompasses all contiguous marine waters of the Beaufort and Chukchi Seas, and much of the Bering Sea, within the U.S. Exclusive Economic Zone (EEZ), containing these “essential features”:

> *(1) Sea ice habitat suitable for the formation and maintenance of subnivean* (i.e., under the snow) *birth lairs used for sheltering pups during whelping and nursing, which is defined as seasonal landfast (shorefast) ice, except for any bottomfast ice extending seaward from the coast line in waters less than 2 m deep, or dense, stable pack ice, that has undergone deformation and contains snowdrifts at least 54 cm deep.*

(2) Sea ice habitat suitable as a platform for basking and molting, which is defined as sea ice of 15 % or more concentration, except for any bottom-fast ice extending seaward from the coast line in waters less than 2 m deep.

(3) Primary prey resources to support Arctic ringed seals, which are defined to be Arctic cod, saffron cod, shrimps, and amphipods (NOAA 2019a).

Bearded Seal

The Beringia and Okhotsk DPSs of bearded seals were listed as threatened in 2012; only the Beringia DPS is present in Alaskan waters. Bearded seals are generally found in moving ice and areas of open water. They can be found in the Bering Strait region all year, although a large portion of the population migrates north into the Arctic Ocean during the summer and early fall. Many juveniles remain in the Bering Sea during summer, feeding in bays and estuaries. No CH has yet been proposed for this species.

Steller Sea Lion

The Steller sea lion was listed as a threatened species under the ESA in November 1990 (55 FR 49204). In 1997, NMFS reclassified Steller sea lions into two DPSs based on genetic studies and other information (62 FR 24345); at that time, the eastern DPS was listed as threatened, and the western DPS was listed as endangered (NMFS 2008).

Steller sea lions prefer the colder temperate to subarctic waters of the North Pacific Ocean. Haul outs and rookeries usually consist of beaches (gravel, rocky or sand), ledges, and rocky reefs. In the Bering Sea and Okhotsk Sea, sea lions may also haul out on sea ice, but this is considered atypical behavior. CH for Steller sea lions was designated in 1993 and is described in 50 CFR §226.202. CH in Alaska west of 144°W longitude consists of:

a) Aquatic zones that extend 20 nautical miles (nm), or 37 kilometers (km), seaward of each major haul out, and major rookery (as listed in Tables 1 and 2 to 50 CFR §226).
b) Terrestrial zones that extend 3,000 ft (0.9 km) landward from each major haul out and major rookery.
c) Air zones that extend 3,000 ft (0.9 km) above the terrestrial zone of each major haul out and major rookery in Alaska.
d) Three aquatic foraging areas: the Shelikof Strait area, the Bogoslof area, and the Seguam Pass area, as specified at 50 CFR §226.202(c).

The vast majority of designated CH sites for the Western DPS are along the Aleutian Islands and Alaska Peninsula; a project-related barge traveling from Anchorage to Nome would pass through the 20-nm aquatic zones of numerous CH Bogoslof special aquatic foraging areas. The nearest Steller sea lion CH to Nome is on the east shore of St. Lawrence Island, about 140 miles to the southwest. However, Steller sea lions, especially juveniles and non-breeding males, can range through waters far beyond their primary use areas. Observations suggest that Steller sea lions are becoming common in the northern Bering Sea. Their change in range is perhaps attributed to climate change-driven movement of pelagic fish prey species, such as Pacific cod, northward (Gay Sheffield, personal communication, 2018).

Bowhead Whale

Four distinct populations of bowheads are recognized worldwide; the only population found in U.S. waters is the Western Arctic stock, also known as the Bering-Chukchi-Beaufort stock. The United States listed all bowhead whales as endangered under the ESA in 1973 (NOAA 2018b).

Western Arctic bowheads winter in the Bering Sea along the southern edge of pack ice or within polynyas. In March and April, most bowheads are thought to migrate along leads in the ice through the Chukchi Sea to summering areas in the Beaufort Sea. From August to October, they migrate back west to Point Barrow and pass through the Bering Strait by November (ADFG 2008c). Norton Sound is at the outer limit of their typical range (Oceana & Kawerak, Inc. 2014; Smith et al. 2017), but a bowhead whale would most likely to found in the vicinity of Nome during the winter, as sea ice extends into Norton Sound. No CH has been established for this species.

Humpback Whale

Humpback whales were listed on the ESA in 1973. Guidance from the NMFS on humpback whales occurring in Alaskan waters (NMFS 2016a) discusses three DPS:

- Western North Pacific DPS (ESA endangered);
- Mexico DPS (ESA threatened); and
- Hawaii DPS (not listed under the ESA).

Whales from the Western North Pacific, Mexico, and Hawaii DPSs overlap to some extent in feeding grounds off Alaska. An individual humpback whale encountered in the Bering Sea has an 86.5 % probability of being from the unlisted Hawaii DPS, an 11.3 % chance of being from the threatened Mexico DPS, and a 4.4 % chance of being from the endangered Western North Pacific DPS (Table 8).

Table 8. Humpback Whale DPS Distribution in Alaskan Waters

Summer Feeding Areas	Hawaii DPS (not listed)	Mexico DPS (threatened)	Western North Pacific DPS (endangered)
Aleutian Islands, Bering, Chukchi, and Beaufort Seas	86.5%	11.3%	4.4%
Gulf of Alaska	89.0%	10.5%	0.5%

The humpback whale is seasonally migratory, mating and calving in tropical and subtropical waters in winter, but spending summers feeding in temperate and subpolar seas. In Alaskan waters, humpbacks concentrate in southeast Alaska, Prince William Sound, lower Cook Inlet, and along the Aleutian Islands in summer. Some humpback whales summer in the Bering Sea, even venturing into the Chukchi Sea. In 2007, humpbacks were spotted in the Beaufort Sea east of Utqiaġvik, suggesting a northward expansion of their summer feeding range (ADFG 2018a). Humpback whales are most likely to be in the vicinity of Nome during the summer and fall.

North Pacific Right Whale

The North Pacific right whale was listed on the former Endangered Species Conservation Act and continued to be listed as endangered following the passage of the ESA in 1973. The listing was later divided into two separate endangered species: North Pacific right whales and North Atlantic right whale then divided into two separate endangered species: North Pacific right whales and North Atlantic right whales. Two areas of CHs designated in 2008 (73 FR 19000; Figure 32) occur in areas that could encounter project-related shipping, although barges are more likely to travel the more direct route through the relatively sheltered waters of Shelikof Strait rather than run south of Kodiak Island.

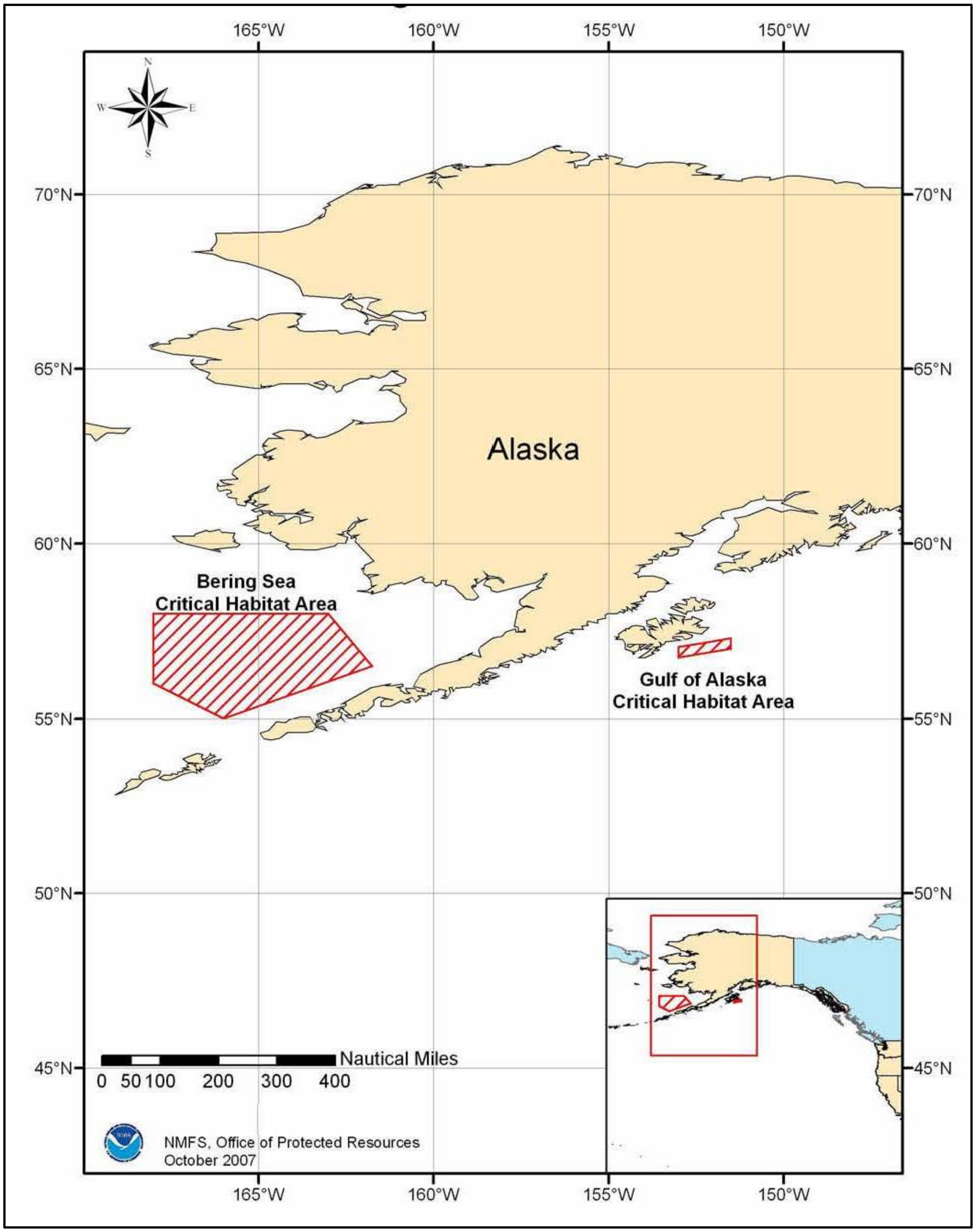

Figure 32. North Pacific Right Whale critical habitat.

North Pacific right whales are found from Baja California to the Bering Sea with the highest concentrations in the Bering Sea, Gulf of Alaska, Okhotsk Sea, Kuril Islands, and Kamchatka area. They are primarily found in coastal or shelf waters. Seasonal distribution of this species is poorly understood (NMFS 2013), though recent studies of long-term acoustic monitoring suggest they may venture farther into the northern Bering Sea than previously thought (Wright et al. 2019). In the spring through the fall, their movements are believed to follow the distribution of prey, primarily high densities of zooplankton. In the winter, pregnant females move to shallow waters in low latitudes to calve; the winter habitat of the rest of the population is unknown (ADFG 2018b). This species would most likely be present in the vicinity of Nome in the summer.

Western North Pacific Gray Whale

Gray whales occur in two isolated geographic distributions within the North Pacific Ocean: the eastern North Pacific stock, found along the west coast of North America, and the western North Pacific or "Korean" stock, found along the coast of eastern Asia. Most of the eastern North Pacific stock spends the summer feeding in the northern Bering and Chukchi Seas, but some have been reported feeding in waters between southeast Alaska and northern California. Most of the eastern North Pacific stock spends the summer feeding in the northern Bering and Chukchi Seas. Still, some gray whales have also been reported feeding along the Pacific coast during the summer, in waters off of Southeast Alaska, British Columbia, Washington, Oregon, and northern California. Most of the eastern North Pacific stock spends the summer feeding in the northern Bering and Chukchi Seas, but some gray whales have also been reported feeding along the Pacific coast during the summer, in waters off of Southeast Alaska, British Columbia, Washington, Oregon, and northern California. In the fall, gray whales migrate from their summer feeding grounds, heading south along the coast of North America to spend the winter in their wintering and calving areas off the coast of Baja California, Mexico. Most of the eastern North Pacific stock spends the summer feeding in the northern Bering and Chukchi Seas, but some gray whales have also been reported feeding along the Pacific coast during the summer, in waters off of Southeast Alaska, British Columbia, Washington, Oregon, and northern California. In the fall, gray whales migrate from their summer feeding grounds, heading south along the coast of North America to spend the winter in their wintering and calving areas off the coast of Baja California, Mexico.

A small number of endangered Western North Pacific DPS of gray whales make their way to the coastal waters of North America during the summer and autumn feeding season, mixing with the unlisted Eastern Pacific population (Moore et al. 2018). The probability of encountering a western north Pacific gray whale in the Bering Sea is unknown. No CH is designated for this species.

Cook Inlet Beluga Whale

In U.S. waters, the NMFS has identified five stocks of beluga whales, all of which are found in Alaskan waters. These are the Beaufort Sea, Bristol Bay, eastern Bering Sea, eastern Chukchi Sea, and Cook Inlet stocks; each is isolated from one another genetically and physically by preferred habitats and migration routes. The Cook Inlet DPS is the only beluga stock currently listed under the ESA. The Cook Inlet beluga population declined by nearly 75 % since 1979, from about 1,300 whales to an estimated 328 whales in 2016 (NOAA 2019c). Cook Inlet DPS beluga whales are encountered in Cook Inlet year-round, although they tend to concentrate at the northern end of Cook Inlet during the summer months, then disperse more widely through the inlet during autumn, winter, and spring (NMFS 2016b). CH the rest of the year (Figure 33).

Cook Inlet beluga are being considered based on vessels that may transit out of Cook Inlet into the project area, as per NMFS correspondence.

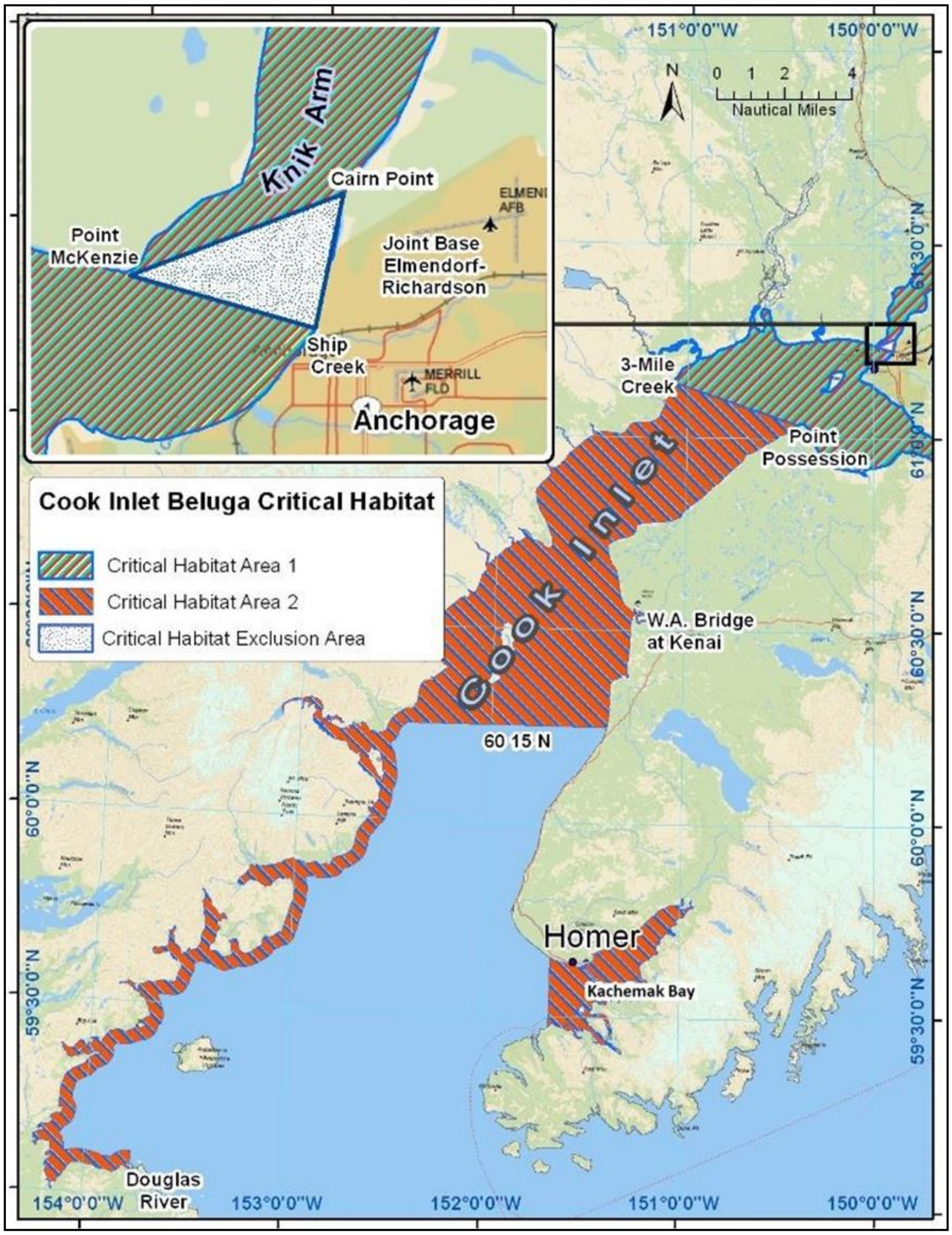

Figure 33. Critical Habitat for Cook Inlet Beluga Whales (NMFS 2016b).

Fin, Sperm, and Blue Whale

These great whales are deep water oceanic species that range throughout the North Pacific Ocean and would be encountered only incidentally by project-related vessels. Fin whales are migratory, generally spending the spring and early summer in cold, high latitude feeding waters. Populations tend to return to low latitudes for the winter breeding season, though they may remain in residence in their high latitude ranges if food resources remain plentiful. In the eastern Pacific, fin whales typically spend the winter off the central California coast and into the Gulf of Alaska. In summer, they migrate as far north as the Chukchi Sea (ADFG 2008).

Sperm whales generally venture no further north into the Bering Sea than about 62°N latitude, preferring to feed in the Gulf of Alaska south of St. Lawrence Island and along the Aleutian Islands. There is no well-defined north-south migration of North Pacific sperm whales. The females and young remain in tropical and temperate waters year-round, with males joining them in the breeding season, but ranging into higher latitudes to feed at other times (ADFG 2018c).

Blue whales in Alaskan waters are most likely to be found in the Gulf of Alaska and along the Aleutian Islands. They are thought to move into high-latitude waters in the spring and spend winters in temperate or tropical areas, but little is known about population-wide movements (ADFG 2018d).

No CH has been designated for fin, sperm, or blue whales.

Polar Bear

The polar bear is a maritime carnivore dependent on arctic sea ice and the associated assemblage of sea mammals. It is listed as a threatened species under the ESA throughout its range (73 FR 28212), due to observed and anticipated changes to its sea ice habitat; the polar bear is also protected under the Marine Mammal Protection Act (MMPA). Polar bears are widely distributed throughout the arctic, with a worldwide population estimated at 20,000 to 25,000. Sea ice provides polar bears with a platform for hunting and feeding, breeding, and denning. The most productive hunting for ice seals, the polar bear's primary prey, is along ice edges and open leads, so polar bears tend to migrate seasonally with the sea ice edge as it advances in the autumn and retreats in spring (USFWS 2015).

The CH unit for polar bears was designated by the USFWS under the ESA in 2010 (75 FR 76086, USFWS 2010) and includes three habitat units: barrier islands, sea ice, and terrestrial denning habitat. The only CH unit appearing in Nome is 'sea ice.' The nearest 'barrier island' CH exists at Safety Sound, roughly 17 miles southeast of Nome, and at Sledge Island, about 23 miles west of Nome (Figure 34). No terrestrial denning habitat has been identified along the Norton Sound coast.

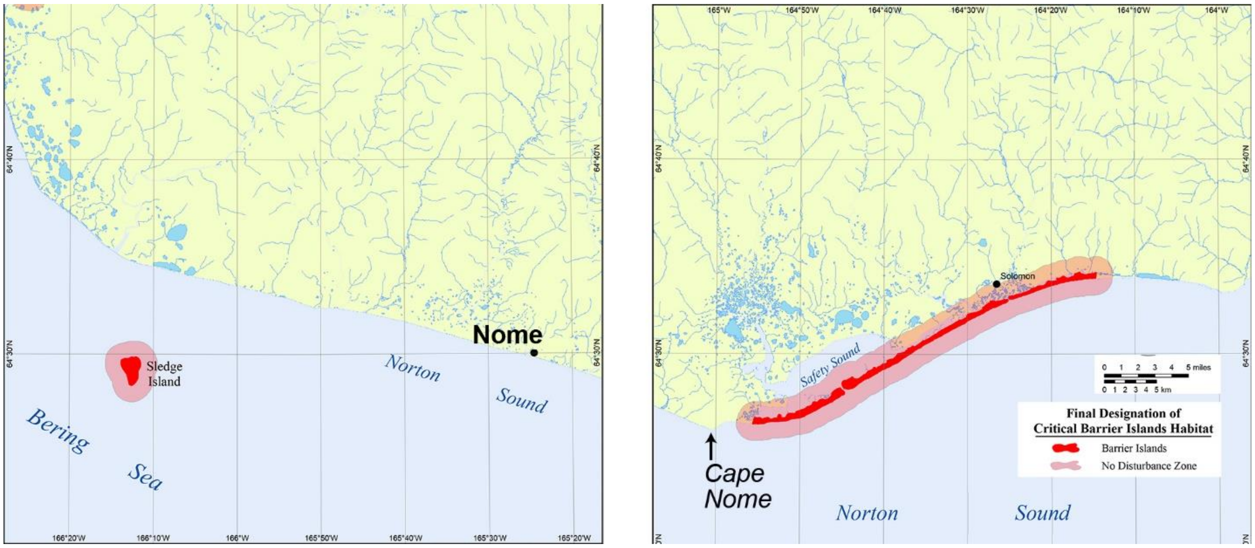

Figure 34. Barrier island polar bear CH identified near Nome (excerpted from maps provided at USFWS 2017).

The geographical extent of the sea ice CH unit reaches from the Beaufort Sea to south of St. Lawrence Island in the Bering Sea and includes all of Norton Sound. As mentioned above, polar bears depend on sea ice for a number of purposes, including as a platform from which to hunt and feed upon seals, as habitat on which to seek mates, breed, and sometimes den, and as a vehicle on which to make long-distance movements. They show a preference for certain sea-ice stages and features, such as stable shore-fast ice, moving ice, and floe ice edges. Polar bears must move throughout the year along with the changing distribution of sea ice and seals, their primary food source. Sea ice disappears from the Bering Sea and Norton Sound in the summer, and polar bears are occupying these areas move as much as 600 miles to stay with the retreating pack ice (USFWS 2010, USFWS 2015).

Coastal barrier islands and spits off the Alaska coast provide areas free from human disturbance and are important for denning, resting, and migration along the coast. Polar bears regularly use barrier islands to move along the Alaska coast as they traverse across the open water, ice, and shallow sand bars between the islands (USFWS 2010). Designated barrier island CH includes a 1-mile buffer zone to minimize disturbances to polar bears (Figure 34); the barrier island CH at Safety Sound and Sledge Island lies outside of the project ROI.

While polar bears may be present near Nome, population studies suggest that typical polar bear winter foraging and denning ranges do not extend far into Norton Sound and that Nome is near the margin of those ranges (Figure 35; Smith et al. 2017). The likelihood of a polar bear appearing near Nome would be highest when dense sea ice is present in Norton Sound, roughly November through May, and minimal when sea ice is absent. Rarely, a polar bear may be stranded on the Norton Sound coast when the sea ice retreats in the spring (ADFG 2012).

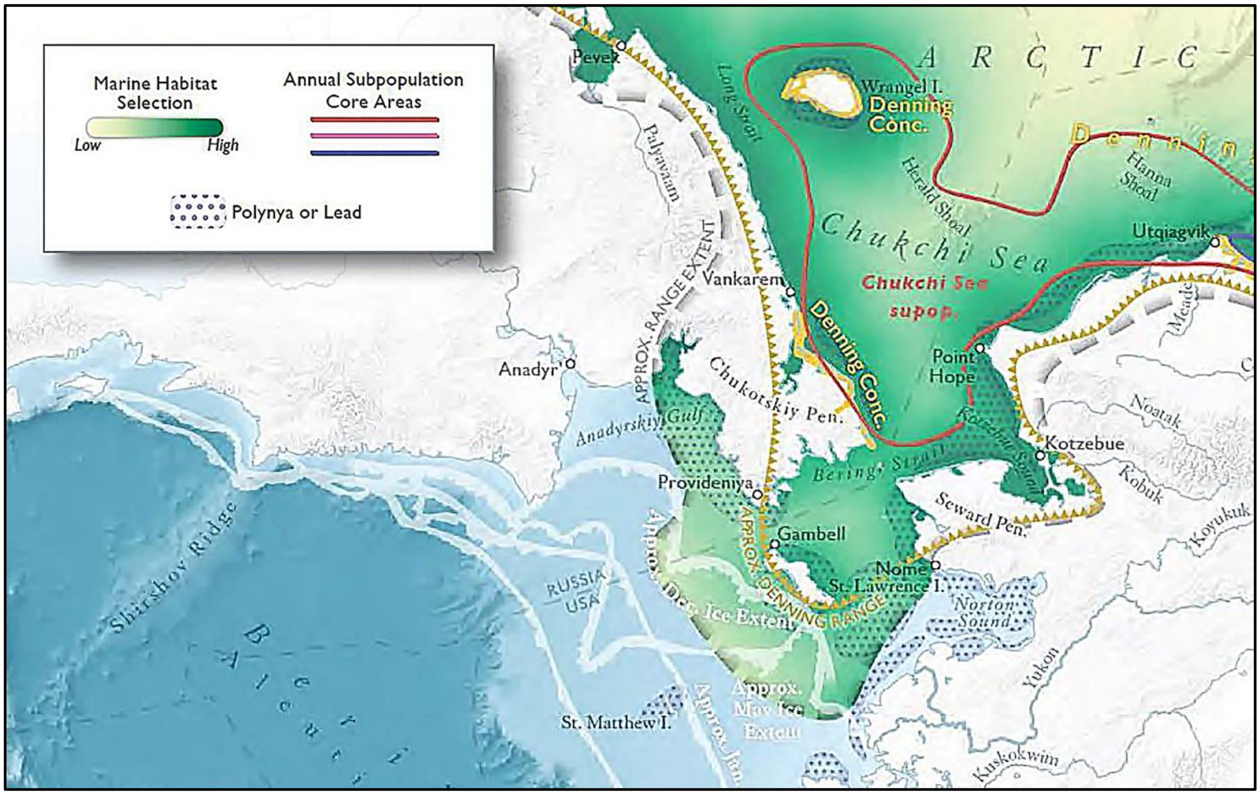

Figure 35. Extent of polar bear winter migration and denning ranges (adapted from Smith et al. 2017).

Spectacled Eider

Spectacled eiders are large sea ducks that spend most of their life cycle in the arctic environment. They were listed as a threatened species throughout their range in 1993 based on indications of steep declines in the Alaska-breeding populations.

From November through March or April, spectacled eiders remain in open sea, polynyas, or open leads in the sea ice of the northern Bering Sea; the availability of sea ice as a resting platform is believed to be important for energy conservation. As open water becomes available in spring, breeding pairs move to nesting areas on wet coastal tundra along the Arctic Ocean coast, or along the Bering Sea coast of the Yukon-Kuskokwim Delta (Figure 36). Males return to the marine environment after incubation begins. Females move to molting areas in July if unsuccessful at nesting, or in August-September if successful. Spectacled eiders molt in several discrete areas of shallow coastal water during late summer and fall. Spectacled eiders generally depart all molting sites in late October to early November, migrating offshore in the Chukchi and Bering Seas to a single wintering area in openings in the pack ice of the central Bering Sea south/southwest of St. Lawrence Island (Figure 36).

Figure 36. Spectacled eider use areas and migration patterns (USFWS 2015).

CH designated for spectacled eiders consists of wintering habitat in the Bering Sea south of St. Lawrence Island, nesting habitat along the coast of the Yukon-Kuskokwim Delta, and molting areas in eastern Norton Sound, and Ledyard Bay on the Chukchi Sea coast (Figure 37).

None of the identified spectacled eider concentration areas or CH is in the vicinity of Nome or within the project ROI; the closest CH unit, the Eastern Norton Sound Unit, is roughly 80 miles to the east. Spectacled eiders found near Nome would most likely be transients migrating between breeding, molting, and wintering areas.

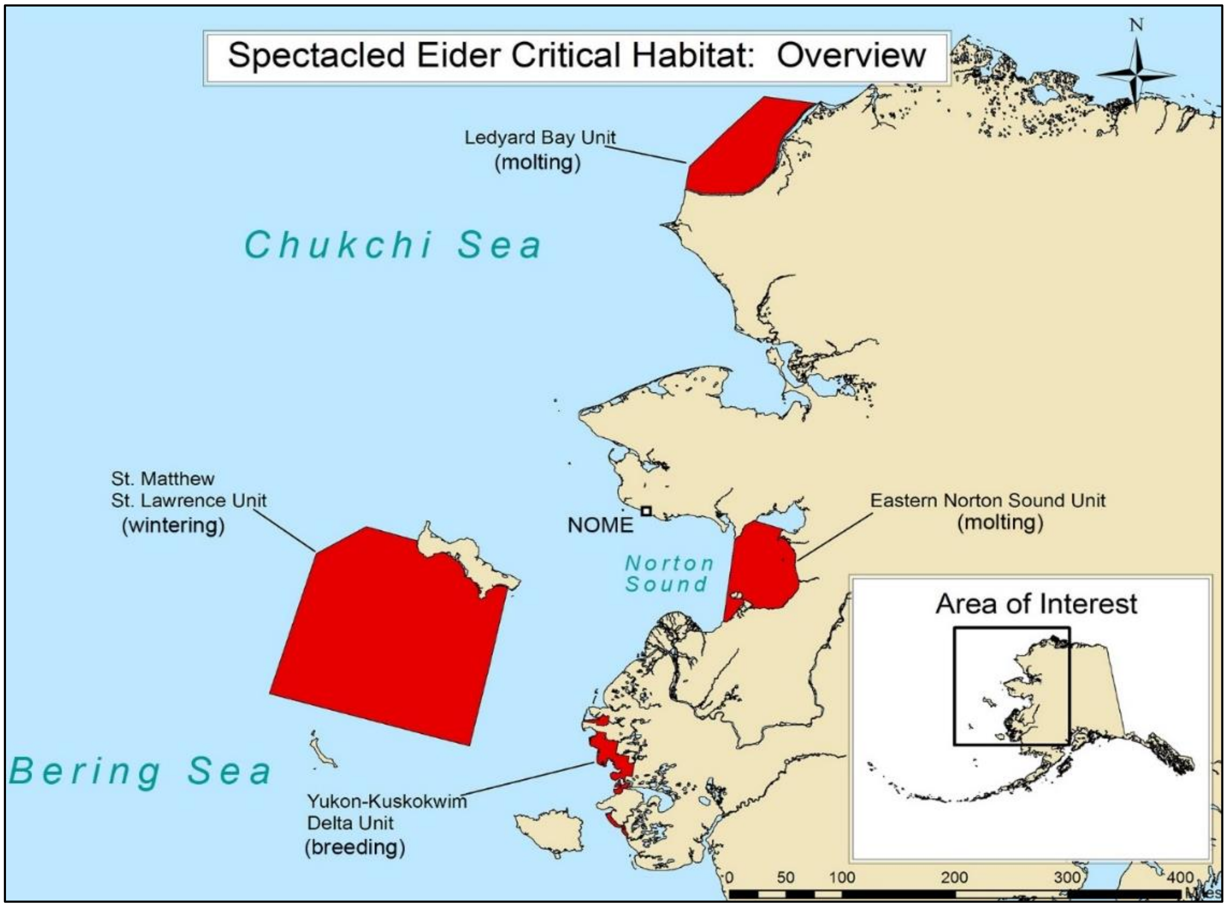

Figure 37. Spectacled eider critical habitat (adapted from USFWS 2013).

<u>Steller's Eider</u>

The Steller's eider is a sea duck that has both Atlantic and Pacific populations. The Pacific population consists of both a Russia-breeding population (which nests along the Russian eastern arctic coastal plain) and an Alaska-breeding population. The Alaska-breeding population of the Steller's eider was listed as threatened in July 1997 based on substantial contraction of the species' breeding range in Alaska, overall reduced numbers breeding in Alaska, and vulnerability of the Alaska-breeding population to extinction (USFWS 2015).

Most of the Pacific population winters in the Aleutian Islands and along the Alaska Peninsula then migrates along the Bristol Bay coast towards arctic nesting grounds in the spring. Steller's eiders arrive in small flocks of breeding pairs on the Alaskan arctic coastal plain (ACP) in early June, and in similar habitat along the arctic coast of Russia (Figure 38). Nesting on the ACP is concentrated in tundra wetlands near Utqiaġvik and occurs at lower densities elsewhere on the ACP. Hatching occurs from mid-July through early August. After rearing is complete, both the Russia- and Alaska-breeding populations depart for molting areas in southwest Alaska (such as Izembek Lagoon), where they remain for about three weeks. Following the molt, the Pacific-wintering

Steller's eiders disperse throughout the Aleutian Islands, the Alaska Peninsula, and the western Gulf of Alaska (USFWS 2015).

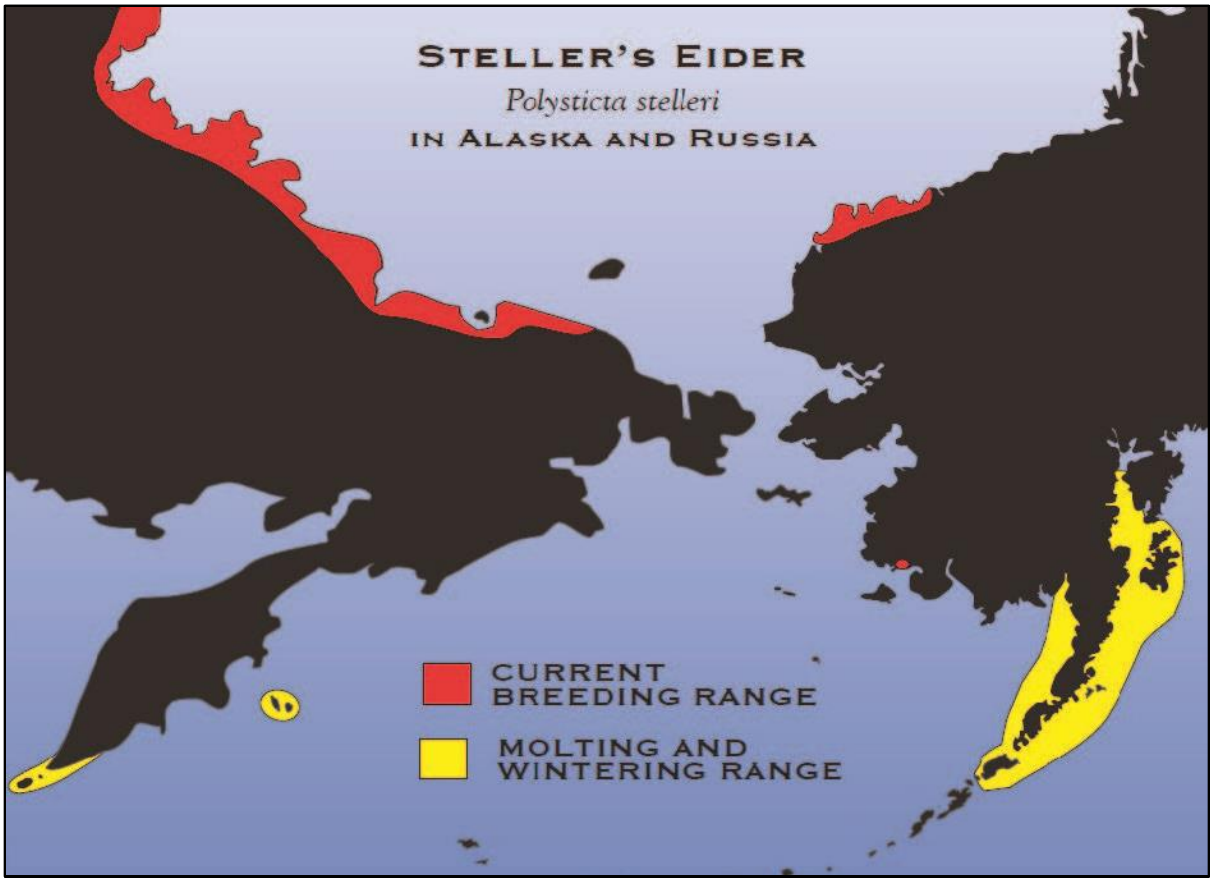

Figure 38. Breeding and wintering range of Steller's eider (USFWS 2013).

CH designated for Steller's eiders consists of breeding areas along the Bering Sea coast of the Yukon-Kuskokwim Delta, and molting areas along the north coast of the Alaska Peninsula (Figure 39).

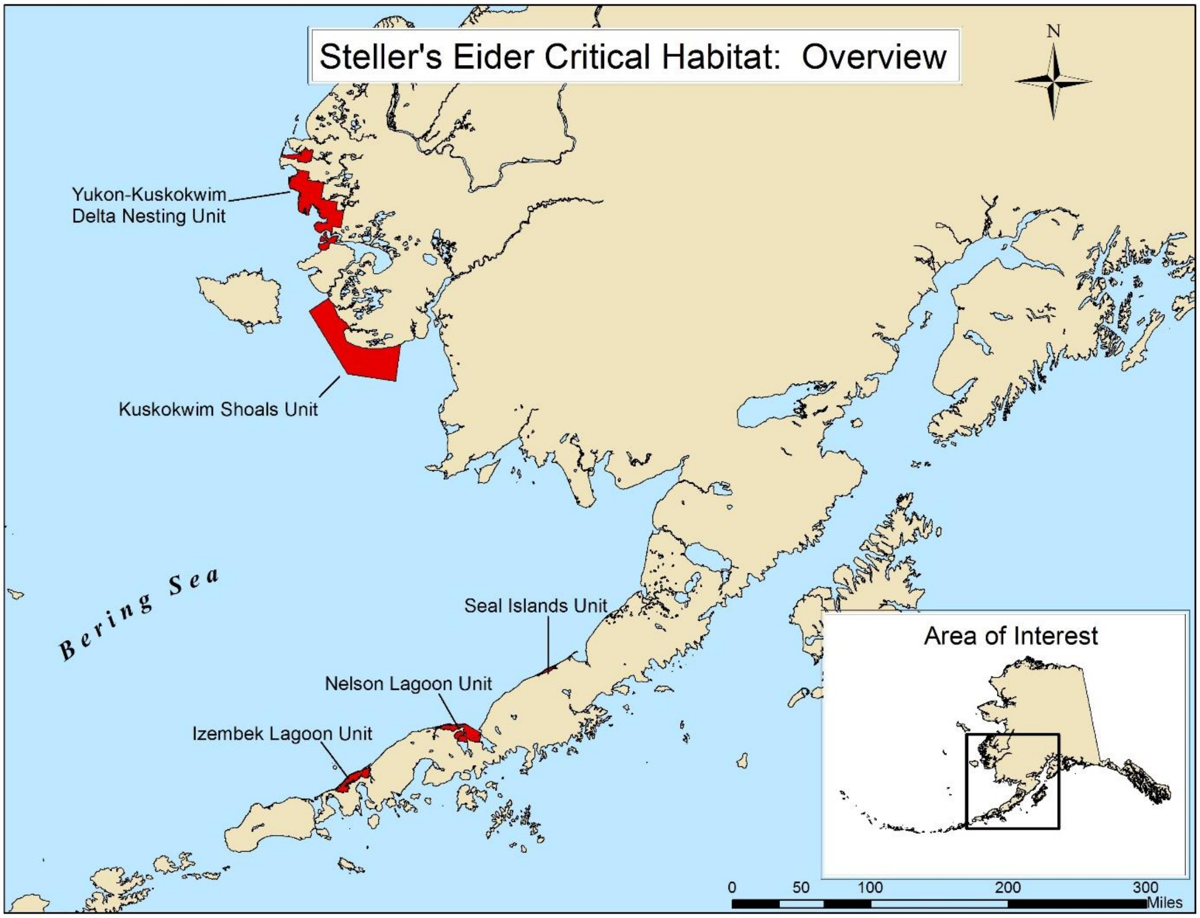

Figure 39. Steller's eider critical habitat (USFWS 2013).

As with spectacled eiders, no identified concentration areas or CH for Steller's eiders are in the vicinity of the project area; any Steller's eiders near Nome would likely be transients migrating between breeding, molting, and wintering areas.

Northern Sea Otter

The CH units designated for the threatened Southwest Alaska DPS for the Northern sea otters are shown in Figure 40. No sea otters are expected, though the transit route would pass sea otter habitat along the Alaska Peninsula. Northern sea otters are primarily nearshore animals; the CH description (USFWS 2013) includes as a primary constituent element (PCE), "*Nearshore waters that may provide protection or escape from marine predators, which are those within 100 meters (328.1 ft) from the mean high tide line.*" A project vessel in transit is unlikely to pass within 100 meters from shore intentionally.

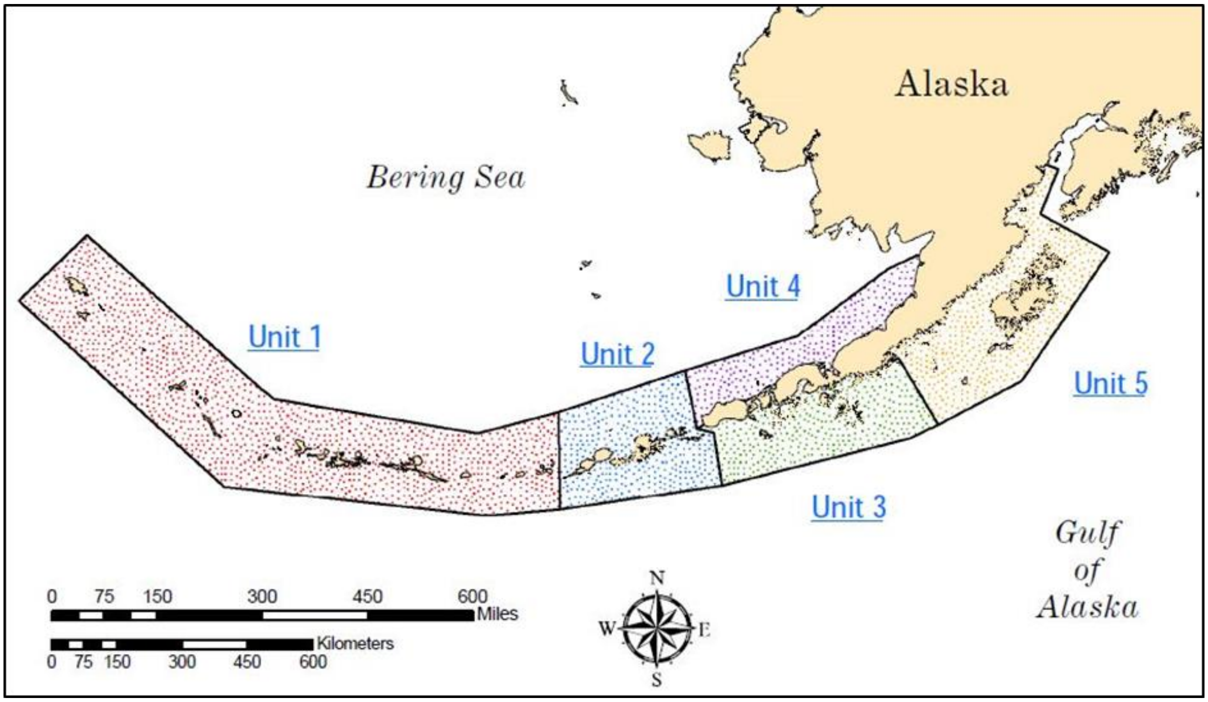

Figure 40. Critical habitat units of the northern sea otter, Southwestern Alaska DPS (USFWS 2013b).

Short-Tailed Albatrosses

Short-tailed albatrosses concentrate along the continental shelf edges of the Gulf of Alaska and Aleutian Basin, where upwelling and high primary productivity result in abundant food resources (Figure 41 USFWS 2008). Project-related vessels traveling to Nome could travel close to areas where short-tailed albatross concentrate to feed. There is no designated CH for this species.

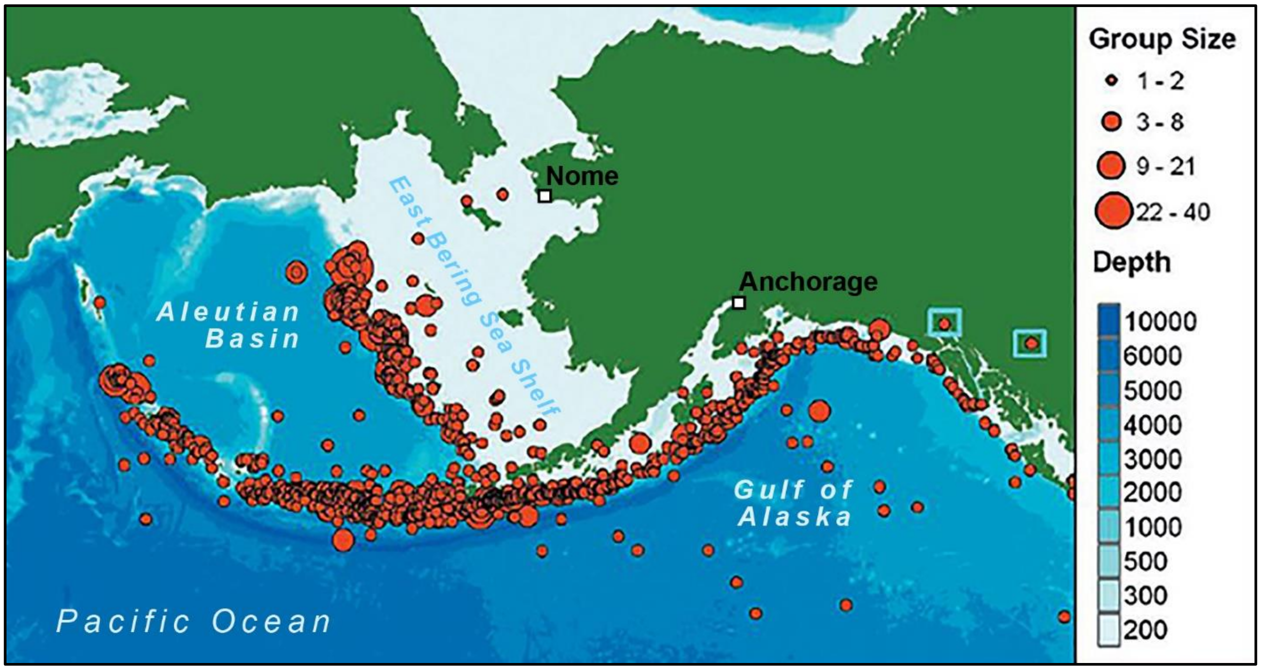

Figure 41. Opportunistic sightings of short-tailed albatross compiled 1944-2004 (adapted from USFWS 2008).

3.2.2.2 Marine Mammal Protection Act

The Marine Mammal Protection Act (MMPA) of 1972 protects all whales, dolphins, porpoises, seals, sea lions, and sea otters, regardless of a species' listing under the ESA. All of the ESA species (see Table 7) are also protected under the MMPA, excluding the birds. Marine mammals not currently listed under the ESA, but protected under the MMPA that may be present in the project area include:

- Pacific walrus (*Odobenus rosmarus*)
- Spotted seal (*Phoca larga*)
- Ribbon seal (*Histriophoca fasciata)*
- Harbor porpoise (*Phocoena phocoena*)
- Killer whale (*Orca orca*)
- Beluga whale, other than Cook Inlet DPS (*Delphinapterus leucas*)
- Stejneger's beaked whale (*Mesoplodon sejnegeri*)
- Sei whale (*Balaenoptera borealis*)
- Minke whale (*Balaenoptera acutorostrata*)
- Gray whale, other than Western North Pacific DPS (*Eschrichtius robustus*)

Many of these species are discussed further in Section 3.2.1.5.

3.2.2.3 Migratory Bird Treaty Act

The Migratory Bird Treaty Act (MBTA) of 1918 implements the United States' commitment to four international treaties for the protection of a shared migratory bird resource. The list of migratory bird species protected by the MBTA appears in 50 CFR §10.13. In Alaska, all native birds except grouse and ptarmigan are protected under the MBTA; grouse and ptarmigan are protected and managed under State of Alaska regulations.

Bird species expected in the project ROIs are discussed above in Section 3.2.1.4.

3.2.3 Essential Fish Habitat and Anadromous Streams

Essential Fish Habitat (EFH) is defined by the Magnuson-Stevens Fishery Conservation and Management Act (MSA) as those waters and substrates necessary to fish for spawning, breeding, feeding, or growth to maturity. The MSA requires Federal action agencies to consult with the NMFS on proposed actions that may adversely affect EFH. Essential Fish habitat in Alaskan waters is designated in several fishery management plans prepared by the North Pacific Fisheries Management Commission (NPFMC).

An EFH Assessment has been prepared for this project, and is provided in Appendix H. The USACE has identified marine EFH in the Norton Sound ROI for all five species of Pacific salmon; eight species of Bering Sea groundfish; and red king crab (Table 9). Norton Sound red king crab is an subsistence and commercial fishery species, and EFH for juvenile red king crab, in the form of “substrates consisting of rock, cobble, and gravel and biogenic structures such as boltenia, bryozoans, ascidians, and shell hash” (NPFMC 2011) has been identified within the project footprint (Figure 21; Section 3.2.1).

Habitat areas of particular concern (HAPCs) are specific sites within marine EFH that are of particular ecological importance to the long-term sustainability of managed species, are of a rare type, or are especially susceptible to degradation or development. The NPFMC may designate specific sites as HAPCs and may develop management measures to protect habitat features within HAPCs. There are no HAPCs designated within Norton Sound or near the project area.

Table 9. EHF identified within the Norton Sound ROI

Species	Life-Stage	Seasons	Fishery Management Plan
Pink salmon	Juvenile	Spring, summer	Salmon[1]
Chum salmon	Juvenile, mature	Spring, summer, fall	Salmon[1]
Sockeye salmon	Juvenile	Spring, summer	Salmon[1]
Coho salmon	Juvenile, immature, mature	Spring, summer, fall	Salmon[1]
King salmon	Juvenile	Spring, summer	Salmon[1]
Pacific cod	Adult	Spring, summer	BSAI groundfish[2]
Yellowfin sole	Egg, larvae, juvenile, adult	Summer	BSAI groundfish[2]
Arrowtooth flounder	Juvenile, adult	Summer	BSAI groundfish[2]
Northern rock sole	Adult	Spring, summer	BSAI groundfish[2]
Southern rock sole	Adult	Spring	BSAI groundfish[2]
Alaska plaice	Adult	Summer	BSAI groundfish[2]
Flathead sole	Juvenile, adult	Summer	BSAI groundfish[2]
Octopus	Adult	Spring	BSAI groundfish[2]
Red king crab	Juvenile, adult	Winter	BSAI crab[3]

1. Fishery Management Plan for the Salmon Fisheries in the EEZ off Alaska (NPFMC 2018a).
2. Fishery Management Plan for Groundfish of the Bering Sea and Aleutian Islands Management Area (NPFMC 2018b).
3. Fishery Management Plan for Bering Sea/Aleutian Islands King and Tanner Crabs (NPFMC 2011).

EFH for Pacific salmon includes freshwater habitat and extends to all streams, lakes, wetlands, and other water bodies currently, or historically assessable to salmon. The State of Alaska manages these waters and their salmon fisheries. The location of many freshwater water bodies used by salmon are contained in documents organized and maintained by the Alaska Department of Fish and Game (ADFG). ADFG is required to specify the various streams that are important for spawning, rearing, or migration of anadromous fishes, and this is accomplished through the *Catalog of Waters Important for Spawning, Rearing, or Migration of Anadromous Fishes* and the *Atlas to the Catalog of Waters Important for Spawning, Returning or Migration of Anadromous Fishes* (NPFMC 2018a). An annotated screenshot from the ADFG's Anadromous Waters Catalog interactive mapping website (ADFG 2018) is shown in Figure 42. The figure points out the six ADFG-cataloged salmon streams that discharge into Norton Sound within the ROI, along with the salmon species present, and their known use of the lower reaches of those streams. Snake River and Dry Creek discharge directly into Nome harbor, and portions of the inner harbor presumably serve as an estuarine transition area for juvenile salmon acclimating to salt water. Salmon fry and smolt leave the Snake

River freshwater habitat in the second and third week of June. Mature chum and pink salmon return to Snake River between 4 and 25 July, sockeyes from about 20 July to 10 August. Adult coho in-migrations are variable, but generally happen in three weeks between 5 August and 10 September (Lean 2019).

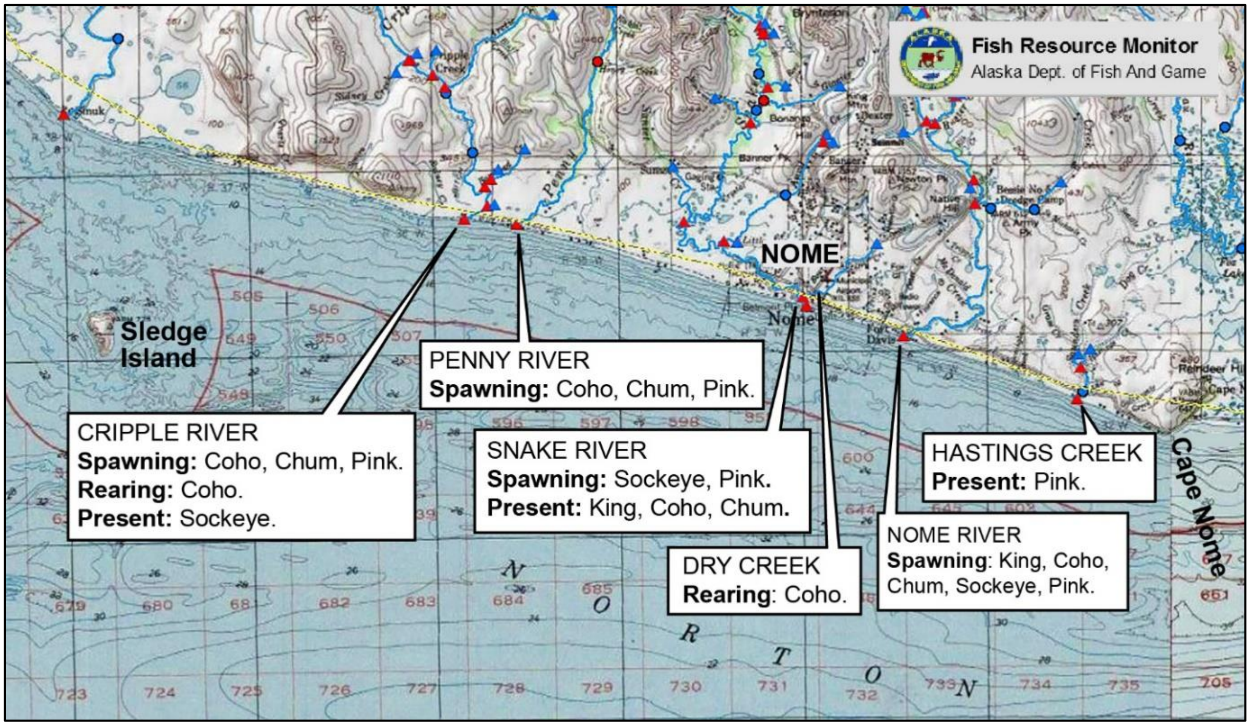

Figure 42. Anadromous streams discharging into the Norton Sound ROI (ADFG 2018).

3.2.4 Special Aquatic Sites

Special aquatic sites, identified as part of the Clean Water Act, are waters of the U.S. possessing special ecological characteristics of productivity, habitat, wildlife protection, or other important and easily disrupted ecological values. These areas are generally recognized as significantly influencing or positively contributing to the general overall environmental health or vitality of the entire ecosystem of a region. The following ecosystems are considered to be special aquatic sites:

- Wetlands
- Coral reefs
- Sanctuaries and refuges
- Mudflats
- Vegetated shallows
- Riffle and pool complexes

As described in Section 3.2.1.6 and shown in Figure 20, several small pockets of estuarine wetlands exist within the ROI where larger streams discharge into Norton Sound. The closest of these to the Port of Nome is at the Nome River, roughly 4 miles to the southeast. Vegetated shallows are defined under the Clean Water Act as "permanently inundated areas that under normal circumstances support communities of rooted aquatic vegetation, such as turtle grass and eelgrass in estuarine or marine systems as well as a number of freshwater species in rivers and lakes" (40 CFR 230.43). Eelgrass is abundant in some large sheltered lagoons along the Norton Sound coast, such as Safety Sound and Golovnin Lagoon (Figure 43), but would not be expected to flourish in the dynamic nearshore sediments off of Nome. The August 2018 substrate survey described in Section 3.2.1 above found only sporadic rooted vegetation in the nearshore environment.

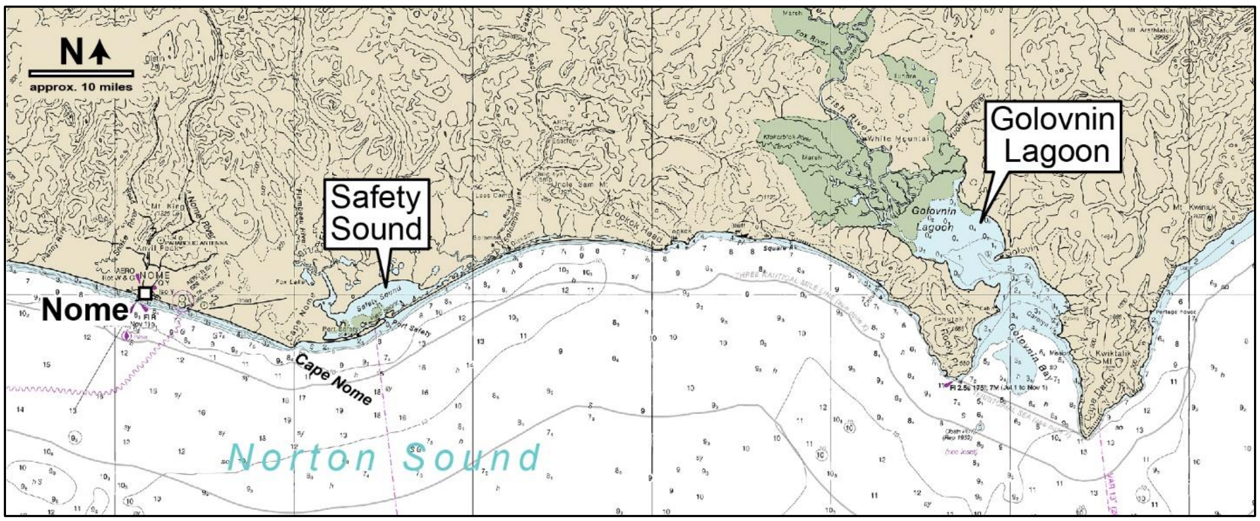

Figure 43. Locations of Safety Sound and Golovnin Lagoon.

3.3 Cultural Resources

The City of Nome is located at the northern edge of Norton Sound, which forms the southern boundary of the Seward Peninsula. There are 21 known cultural resources in the vicinity of the Port of Nome (Table 10). These include above-ground structures, such as the Old St. Joseph's Catholic Church (NOM-00040); trails, such as the Samuelson Trail (NOM-00244); and subsurface sites, such as the Snake River Sandspit Site (NOM-00146). Another important cultural resource in the area is the Sitnasuaŋmiut Quŋuwit Cemetery (NOM-00264). Norton Sound has been inhabited for thousands of years. For a more in-depth evaluation of the historical context of the Nome area, please refer to the USACE's letter to the Alaska State Historic Preservation Officer (SHPO) in Appendix G.

Table 10. Known historic and cultural resources in the vicinity of the proposed navigation improvements (AHRS 2019).

AHRS #	Site Name	NRHP Status
NOM-00025	Sitnasuak	Unevaluated
NOM-00032	Carrie McLain House	De-listed [Destroyed]
NOM-00033	Catholic Hospital	Unevaluated [Destroyed]
NOM-00035	Methodist Church	Unevaluated [Destroyed]
NOM-00036	LT C.V. Donaldson	De-listed [Destroyed]
NOM-00040	Old St. Joseph's Catholic Church	**Listed**
NOM-00083	Ft. Davis Guardhouse	Not Eligible
NOM-00146	Snake River Sandspit Site	**Eligible**
NOM-00158	Nome (Subsurface Historic District)	Unevaluated
NOM-00167	Nome Historic District	Closed
NOM-00176	Belmont Point Cemetery	Not Eligible
NOM-00177	Cowin Hut – North Example	Unevaluated [Destroyed]
NOM-00178	Cowin Hut – South Example	Not Eligible
NOM-00179	Valve/Pumphouse	Unevaluated [Destroyed]
NOM-00225	1003 Seppala Drive	Unevaluated
NOM-00226	Garage on Seppala Drive	Unevaluated
NOM-00227	Blue-Green House on Belmont Street	Unevaluated
NOM-00228	308 Belmont Street	Unevaluated
NOM-00229	312 Belmont Street	Unevaluated
NOM-00230	Belmont Apartments	Unevaluated
NOM-00231	315 McLain Lane	Unevaluated
NOM-00244	Samuelson Trail	**Eligible**
NOM-00264	Nome Eskimo Cemetery (Sitnasuaŋmiut Quŋuwit Cemetery)	Unevaluated
NOM-00286	Small House 1	Not Eligible
NOM-00287	Small House 2	Not Eligible
NOM-00291	710 Seppala Drive	Unevaluated
NOM-00307	Single-story Building	Unevaluated

Note: NRHP = National Register of Historic Properties.

3.4 Subsistence Use

Subsistence activities are an integral aspect of daily life for the people of Norton Sound and the surrounding Bering Sea region. Subsistence provides food security, a more healthful diet than is provided by available Western foods, a sense of self-determination, and a unique connection to cultural heritage and the environment. A 2005-2006 Kawerak, Inc., survey of households in twelve villages found that the households harvested an average of 3,760 pounds of subsistence food during the year, with marine mammals making up 67.9 % of that total weight (Oceana & Kawerak, Inc. 2014).

Numerous villages, Alaska Native corporations, and private organizations have participated in efforts, such as the Kawerak Ice Seal and Walrus Project, to collect and document traditional knowledge of subsistence practices and the seasonal distribution of marine mammals and other resources. Maps of seasonal subsistence-use areas are provided in the Oceana & Kawerak Bering Strait subsistence-use data synthesis report (Oceana & Kawerak, Inc., 2014).

Seals are one of the most critical and accessible subsistence resources in the Norton Sound region; all coastal communities participate in the harvest of ice seal species, i.e., bearded, ringed, spotted, and ribbon seals. The availability and distribution of seals depend greatly on the time of year and the different preferences of each species for habitat and ice conditions. Winter hunters look along the shorefast ice near their communities for ringed seals, and at areas of open water near capes and points for bearded seals; a regularly occurring winter polynya forms off of Cape Nome. These areas of open water grow larger in early spring, and hunters must travel farther across the ice to find ringed and bearded seals. As the ice breaks up in spring and early summer, hunters will use boats to look for bearded seals among moving ice. The window for hunting bearded seals and walruses is shorter than for hunting ringed or spotted seals, as bearded seals and walruses migrate north with the receding ice more quickly and thoroughly. Some seals, particularly juveniles, stay within Norton Sound all summer, feeding on fish in rivers and lagoons; these summer seals are not hunted heavily, as their blubber and coats are in poor condition. Autumn is an important seal hunting season for most communities, as seals are abundant, in good condition, and found close to shore. Marine mammals, especially seals, tend to congregate around the Port of Nome causeway and breakwater in the fall, and the Outer Basin is a popular place for subsistence hunters (Kawerak, Inc., 2017).

The Ice Seal Committee (ISC) represents ice seal hunters along the north and west coasts of Alaska and co-manages ice seals with the National Marine Fisheries Service and the Alaska Department of Fish and Game.

Walruses are another important subsistence species in the region, providing both sufficient quantities of meat to share within the community, as well as hides and ivory for traditional boats, drums, and handicrafts. Walruses prefer the outer edge of the sea ice with its access to open water and spend the winter outside of Norton Sound in the central Bering Sea. Walrus hunting takes place primarily in spring and early summer as the sea ice edge retreats northward, and the walruses migrate with it; the availability of walrus during this migration depends on the distribution and condition of sea ice in a given year. The spring migration does not typically bring walruses close to shore near Nome, and Nome-area hunters must travel 10 to 50 miles out to sea to find them. Walruses are mostly absent from Norton Sound in late summer and fall, although a few have been reported at Nome harbor during the ice-free season. The Eskimo Walrus

Commission (EWC) is the co-management organization authorized under the Marine Mammal Protection Act to represent Alaskan walrus hunting communities in managing and conserving walrus (Oceana & Kawerak, Inc., 2014).

Beluga whales are hunted primarily in the spring and fall. Belugas typically congregate in Norton Sound areas to the east of Cape Nome during the spring and summer but may become more numerous in western Norton Sound in the fall. Nome-area hunters harvest belugas from Cape Nome to Sledge Island, sometimes from Belmont Beach right off Nome (Figure 44). Beluga whales occasionally enter the Port of Nome Outer Basin in the autumn. The beluga whale subsistence harvest is co-managed by the Alaska Beluga Whale Committee (ABWC) and the NMFS (Oceana & Kawerak, Inc., 2014).

Fish and shellfish are harvested from marine and freshwater year-round and make up a large portion of the subsistence diet. Salmon fishing occurs from June into late September or early October. Finfish are also harvested through the nearshore ice, with jigging for tomcod being especially popular from November to February. Some residents use the existing Outer Basin for ice-fishing. The notable winter subsistence fishery for Norton Sound red king crab takes advantage of the migration of adult crab into nearshore waters in the late fall and winter. The crab fishery generally occurs from 1 December to 31 May, through holes cut in the shorefast ice or along the shorefast ice active edge; a summer subsistence crab season lasts from late June until early September (Menard 2018).

Figure 44. Belmont Beach boat launch area (middle foreground) near the mouth of the Snake River.

3.5 Socio-Economic Conditions

3.5.1 Demographic Profiles

Inupiat Eskimo occupancy of Norton Sound began at least 5,000 years ago. Before the Gold Rush of 1899, Inupiat people had seasonally inhabited the Nome townsite. An archaeological excavation at the mouth of the Snake River revealed the presence of a winter village which was inhabited around AD 1750. In the 1880 census, 20 inhabitants were recorded at Nome, and 10 inhabitants were recorded at a nearby site at the mouth of the Nome River. The principle settlement at the time was at Cape Nome, 15 miles east of Nome, with a population of 60. Small settlements like those at the Nome occurred along the coast at productive locations for food gathering. The settlements were largely independent of Euroamericans socially and economically until 1899 when the gold rush began.

Nome, known initially as “Anvil City,” was founded on 28 October 1898, as a mining district on the Snake River. The first reports of the discovery of gold in the area date to 1865, when Western Union surveyors entered the area seeking a route across Alaska and the Bering Sea. The Nome Gold Rush officially began with the gold strike on Anvil Creek in 1898. This strike brought thousands of miners to the area, which was termed the “Eldorado.” Almost overnight, the isolated stretch of tundra fronting the beach was transformed into a tent-and-log cabin city of 20,000 prospectors, gamblers, claim jumpers, saloon keepers, and prostitutes. The gold-bearing creeks had already been almost completely staked when an entrepreneur discovered the “golden sands of

Nome." With nothing more than shovels, buckets, rockers, and wheelbarrows, thousands of idle miners descended upon the beaches. Two months later, the golden sands had yielded one million dollars in gold (at $16 an ounce). A narrow-gauge railroad and telephone line from Nome to Anvil Creek was built in 1900. The City of Nome was incorporated in 1901, and the city has been inhabited continuously ever since. By 1902, the more easily reached gold claims were exhausted, and large mining companies with better equipment took over the mining operations. Since the first strike on Anvil Creek, Nome's goldfields have yielded a total of $136 million.

The gold rush population boom severely impacted the Inupiat people of Nome. In 1918 the Native population in the Nome area was estimated to be 250; 200 of those people died during the influenza epidemic. Communities abandoned the area after the epidemic resulting in the decimation of the population over a wide area. The gradual depletion of gold, the influenza epidemic in 1918, the Great Depression, and World War II each influenced Nome's population(Himes et al. 2013) (Figure 45).

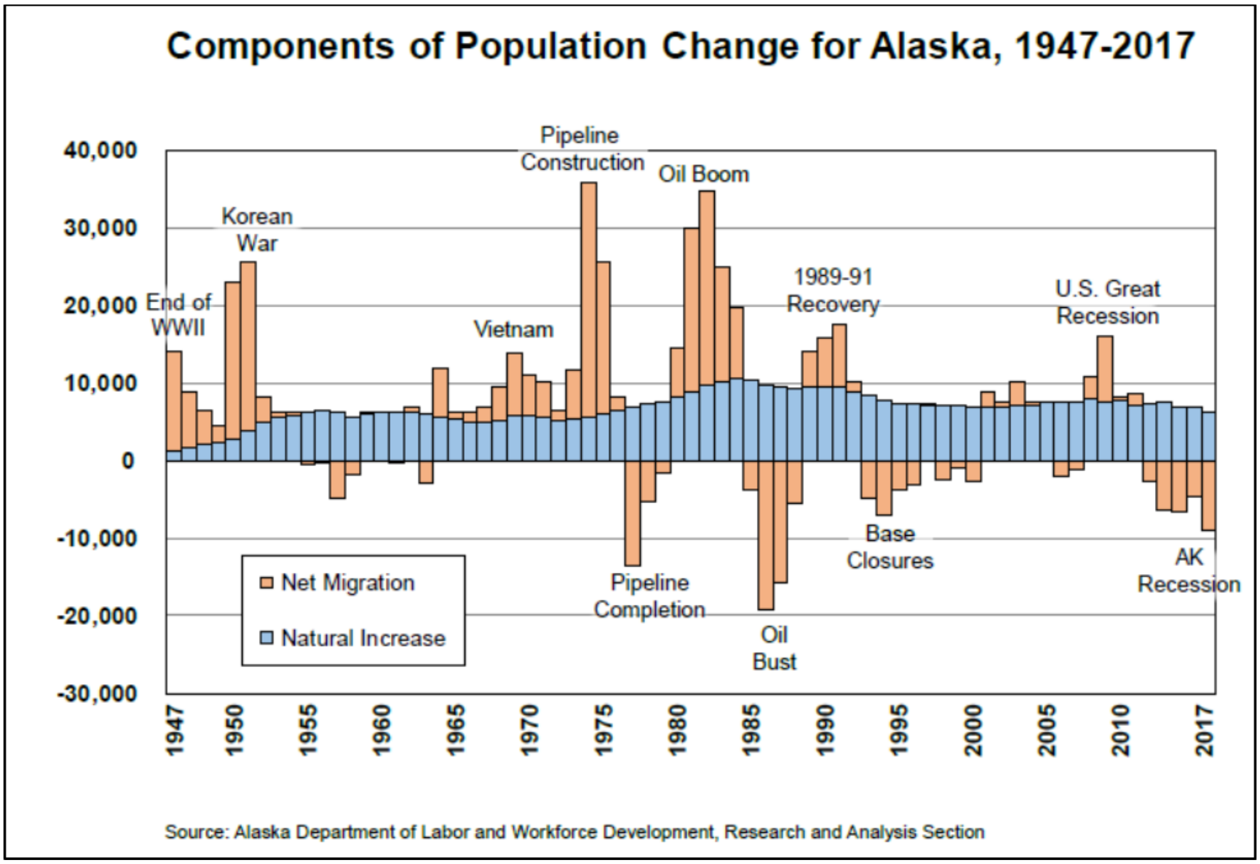

Figure 45. Net Migration in Alaska since 1947.

By 2010, there were 3,598 residents in Nome, ranking it as the 30th largest of 352 communities in Alaska with recorded populations that year. Between 1990 and 2010, the population of Nome stayed relatively stable, increasing by 2.8 % overall. This population stability continues today, as the City of Nome had a population of 3,691 people in 2017 (DCRA 2018); which reflects an increase of only 93 people since the 2010 Census or 2.5 %. According to the Alaska Department of Labor estimates, the 2011 and 2017 populations of permanent residents were the same. However, the average annual growth rate over this period was slightly positive (0.39 %), reflecting small increases and decreases from year to year and an overall slight upward population trend. According to a survey conducted by the Alaska Fisheries Science Center (AFSC) in 2011, community leaders reported that an additional 500 individuals are present in Nome as seasonal workers or transients. The leaders indicated that these seasonal workers are present in Nome throughout the year and that Nome's population typically peaks in July. They noted that the peak is somewhat driven by employment in the fishing industry and that seasonal workers are also employed in construction and gold mining industries, and at the local hospital. In addition to transient seasonal workers, community leaders estimated that 15 to 30 permanent residents work seasonally in the local shore-side seafood processing facility (Himes et al. 2013).

The percentage of the population that identified themselves as American Indian or Alaska Native decreased between 1990 and 2000, from 52.1 % to 51 %, increased to 54.8 % in 2010, then reduced again to 48.5 % in 2016. Outside of the City of Nome, the Nome Census Area contains the cities of Brevig Mission, Diomede, Elim, Gambell, Golovin, Koyuk, Port Clarence, St. Michael, Savoonga, Shaktoolik, Shishmaref, Stebbins, Teller, Unalakleet, Wales, and White Mountain. The total estimated population of the Nome Census Area in 1990 to 2017 is presented in Table 11. Between 1990 and 2010, the Census Area population increased by 14.5 % overall. However, from 2010 to 2017, the rate of growth slowed to 5.4 % but still outpaced both the City of Nome itself (2.5 %) and the State of Alaska (3.8 %) over the same period. The average annual growth rate for the Census Area over this period was slightly positive as well (0.76 %), reflecting small increases and decreases from year to year and an overall slight upward population trend.

Table 11. Population in Nome and Region from 1990 to 2017

	Nome		**Region – Nome Census Area**	
Year	**U.S. Decennial Census**	**Alaska Dept. of Labor Estimate of Permanent Residents**	**U.S. Decennial Census**	**Alaska Dept. of Labor Estimate of Permanent Residents**
1990	3,500		8,288	
2000	3,505		9,196	
2010	3,598		9,492	
2011		3,691		9,718
2012		3,744		9,852
2013		3,648		9,869
2014		3,730		9,986
2015		3,815		10,058
2016		3,773		10,070
2017		3,691		10,006

Source: (U.S. Census Bureau 2018, and Alaska Department of Labor 2017)

3.5.2 Migration

Migration data are not available at the community level. Instead data provided by the Alaska Division of Labor and Workforce Development (AKDOL&WD) at the borough (county) level was used. Over the eight year period, the region lost 643 more people than they gained within the state of Alaska, or about 6 percent of the total regional population. The city of Anchorage and surrounding regions were the largest net recipients of people from the region, while the regions to the north were the largest donors. Despite the growing numbers of people migrating out of the region, the overall regional population increased by 5 percent from 2010-2017. Although there is migration from rural areas, there is migration into rural areas as well. Additionally, there appears to be evidence that migration occur from rural communities to regional hubs, like Nome, and back (Appendix D, Section 3.2).

The Institute of Social and Economic Research (ISER) at the University of Alaska-Anchorage put forth observations and hypotheses surrounding rural-urban migration in Alaska over the last 20 years. Low employment, fuel costs, and public safety are all listed reasons for why people left rural areas (Martin et al. 2018). The same phenomenon exists in their data that is highlighted in this section: a negative net migration occurring at the same time as positive overall population growth. This could be attributed to migration into the region from outside the State of Alaska, immigration from other countries, or natural population increases. However, another study from the ISER (Berman 2017) downplayed the effect of fuel prices on migration indicating and that other factors also affect migration decisions. This 2017 study found that “local labor market conditions, as well as the individual’s employment status and earnings had much stronger effects on out-migration than fuel prices” (Berman 2017).

While it is clear that out-migration (net negative migration) is occurring, it is not clear what factors have the most impact, or how significant migration is relative to overall population trends.

3.6 Existing Fleet, Commodities Transported, Waterway, Dock, and Operating Costs

As noted in Section 2.1, larger deep draft fuel, cargo, and cruise ships are forced to anchor offshore to lighter goods and passengers to the port. The number of these vessels has been increasing. Also, due to a lack of available draft along the western and northern coasts, USCG activity is limited to small vessels and helicopters, with the nearest USCG station to Nome about 800 miles away on Kodiak Island. If a critical need for supplies arises, the USCG uses the Port of Nome to lighter goods to their deep-draft vessels. Spill response vessels with a draft requirement greater than 22 ft would need to do the same.

Existing vessel traffic was chronicled from 2015 through 2017 from data provided by the Port of Nome to establish a baseline level of vessel traffic in the harbor (Appendix D [Economics], Chapter 4). The three principle commodities that moved through Nome and the region were fuels, dry cargo, and gravel. For the economic analysis, vessels were divided into different vessel classes based on type and similarity of their dimensions. Based on the data collected, eleven different vessel classes carry the three main commodities. The Arctic Deep Draft Ports report (USACE 2015) listed characteristics for each of these vessel classes. Since that data is relatively recent, the same characteristics were carried forward to this study. In most instances, the same vessels that were calling on Nome in 2013 are still calling each shipping season. The breakdown of existing vessel classes and their respective characteristics are presented in Table 12.

Table 12. Characteristics by Vessel Class.

Vessel Class	Length (ft)	Beam (ft)	Draft (ft)	Capacity (Metric Tons)
Buoy Tender	225	46	13.0	350
Cutter	378	43	18	2,328
Ice Breaker	420	82	30.0	3,250
Small Landing Craft	78	24	3.5	300
Large Landing Craft	152	50	9.8	500
Large Tug & Barge	380	96	18.0	14,157
Medium Cruise Ship	464	59	16.1	1,177
Medium Research Vessel	269	56	18.4	2,808
Medium Tug & Barge	376	78	18.0	10,653
Small Cruise Ship	234	42	14.8	620
Small Research Vessel	180	40	15.0	730
Small Tug & Barge	299	54	14.0	4,400
Tanker	417	67	28.5	11,611
Tugboat	76	32	5.0	170

The primary source for vessel capacity information was internet research of vessel characteristics by specific vessel as described Appendix D, Section 4. Three classes of tug and barge were established based on general groupings of vessel sizes. The length, beam, draft, and capacity for these classes were defined based on the dimensions of the barge alone, as tugs typically disconnect from barges prior to mooring in order to maneuver the barge into the dock. A medium cruise ship docked at the Port of Nome causeway is shown in Figure 46.

Figure 46. Medium Cruise Ship docked at the Port of Nome Causeway Docks (Source: City of Nome).

The vast majority of the vessels that called at Nome were sailing under the U.S. flag. This is primarily due to Section 27 of the Merchant Marine Act of 1920 (Jones Act) restrictions on "coastwise" trade; or trade between U.S. ports. It stipulates that any vessel that transfers cargo from one U.S. port to another must be a U.S. flagged vessel. Since many supplies are shipped from Seattle or Anchorage, and many shipments from Nome go to communities on the U.S. coast of Alaska, vessels involved in this trade must be Jones Act compliant. However, tankers and cruise ships at Nome are vessels sailing under foreign flags. In addition, many of the research vessels, cutters, ice breakers, and tugboats are foreign-flagged. Foreign-flagged vessels typically have significantly lower operating costs than U.S. flagged vessels.

The total number of vessel calls from 2015 to 2017, by vessel class, are presented in Table 13. A combination of data from USACE's Waterborne Commerce Statistics Center and the Port of Nome was used to determine the ultimate count.

Table 13. Total Vessel Calls to Nome by Class, 2015-2017.

Year	**2015**	**2016**	**2017**
Vessel Class	**Number of Calls**	**Number of Calls**	**Number of Calls**
Buoy Tender	2	1	2
Cutter	8	4	10
Ice Breaker	4	3	4
Large Cruise Ship	0	1	1
Large Landing Craft	33	34	43
Large Research Vessel	0	2	2
Large Tug & Barge	16	18	16
Medium Cruise Ship	3	3	3
Medium Research Vessel	9	6	17
Medium Tug & Barge	51	44	40
Miscellaneous	10	44	17
Small Landing Craft	1	3	1
Small Research	29	12	16
Small Tug & Barge	47	62	67
Tanker	11	11	9
Tugboat	5	6	2
Grand Total	**229**	**254**	**250**

3.6.1 Existing Waterborne Commerce

The city of Nome provided detailed waterborne commerce information for the period from 2012 to 2017. Typically, a 3 to 5-year data range is used to establish a baseline for forecasts into the future. The cargo tonnage that moved through Nome from 2012 to 2017 is shown in Figure 47.

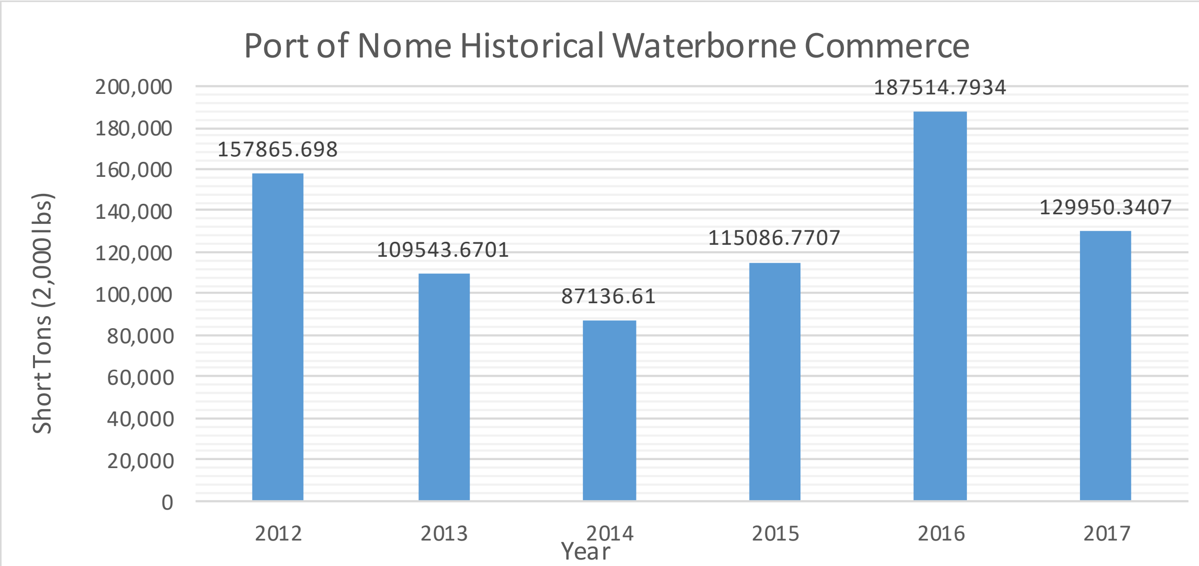

Figure 47. Nome Historical Waterborne Commerce by tons, 2012-2017 (Data Source: Port of Nome Season Commodity Report by Vessel, 2012-2017).

Cargo is composed primarily of three commodities: petroleum products (fuels), gravel, and dry cargo goods. The movements of these goods from 2012 to 2017 are shown in Figure 48.

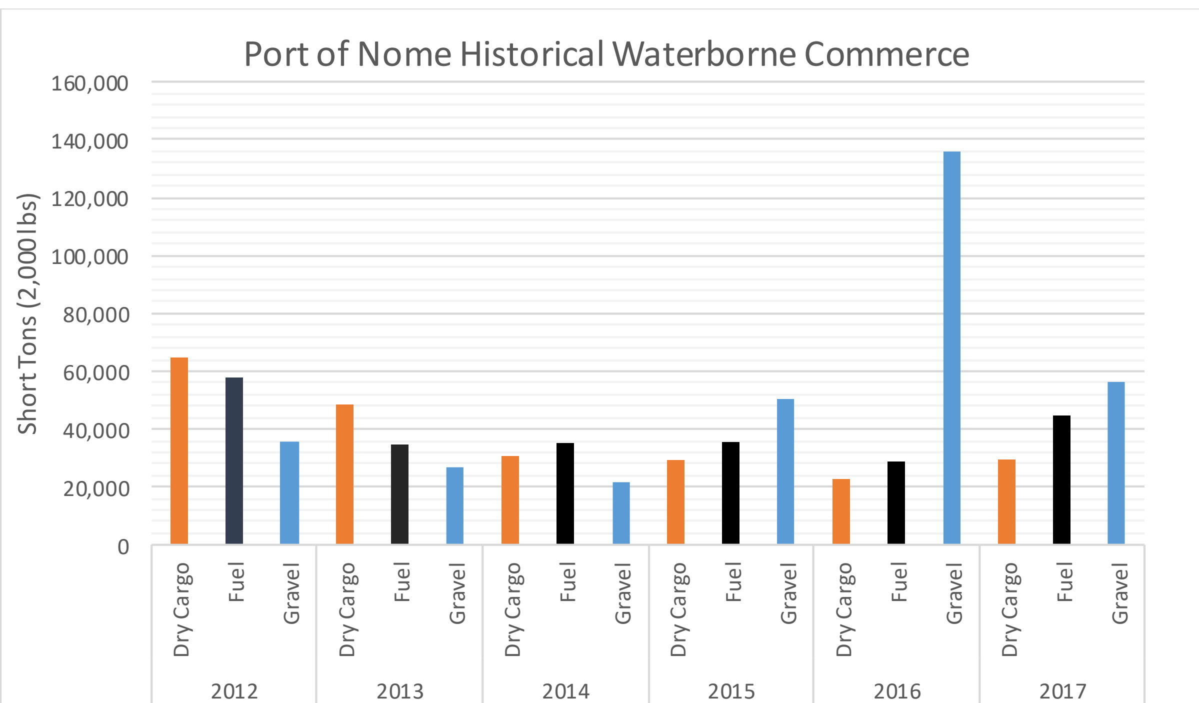

Figure 48. Nome Historical Waterborne Commerce by Commodity and Year, 2012-2017 (Data Source: Port of Nome Season Commodity Report by Vessel, 2012-2017).

Commodity volumes for each respective category can vary significantly over a 2 or 3-year period. Reasons for the varying commodity volumes include the weather and ice conditions around the port of Nome induce large variability in the amount and schedule of goods shipped in and out of Nome. The port is typically iced over from November/December to April/May every year. Most shippers make anywhere from 5 to 8 voyages to western Alaska during the ice-free window each year. If shipping schedules slip too frequently, this can cause shipments from Anchorage or farther away to be canceled entirely if the full delivery cannot be completed before the ice arrives. This can leave Nome, and communities that rely on Nome, with a very difficult situation—either ship the needed goods by air or go without.

Another cause of the variability of shipments, especially for the export of gravel, is the pace of infrastructure spending within the region and state. Rock exported from Nome is mined at the nearby Cape Nome quarry, and gravel is crushed in local pits around Nome and sent around the state. The levels of rock and gravel exported from Nome are directly related to the number and scope of public construction projects around the state that require these materials. Years where those projects are more numerous or larger, like 2016, result in large fluctuations in volumes of rock and gravel shipped.

Finally, shipments are often affected by adverse weather and sea state conditions. This can be a problem at hub communities like Nome, as well as more remote communities "down the line" for ultimate freight delivery. Weather or condition delays at transshipment hubs compound problems with shipping timelines by delaying not just final deliveries, but also back-haul voyages to Anchorage or beyond for re-supply. An accumulation of these effects can cancel entire voyages later in the season.

3.6.2 Fuel

There are typically six different types of fuel moved through the port of Nome: diesel #1, diesel #2, aviation gasoline (Avgas), regular unleaded gasoline (RUL), jet fuel (Jet A), and heating fuel. The two types of diesel fuels and heating fuel are used for heavy equipment fuel, municipal and private power generation as well as heating purposes. Jet fuel and aviation gasoline are delivered to the airport for the variety of planes operating there. Regular unleaded gasoline is used for vehicle/miscellaneous fuel at service stations in town. Movements are dominated by imports, even though regular exports do occur, as shown in the chart below. Exports are typically captured by the vessels that call on Nome to refuel via pipeline at the causeway docks. That includes the regular barge vessel traffic as well as the many ancillary vessels that call each year. Examples of these are the United States and foreign government vessels, research vessels, cruise ships, and miscellaneous support vessels. Smaller vessels can also be refueled by tanker trucks supplied by local fuel distributors. These trucks typically deliver approximately 250,000 gallons of fuel each year, in addition to what is delivered by pipeline to the docks.

Total fuel imports vary significantly from year to year, for reasons discussed in previous sections. Each year, anywhere from 25 to 50 thousand tons of fuel come into Nome (Figure 49). Exports do still occur, albeit at decreasing levels, even after the rise of the "floating gas station" model came into effect in 2013.

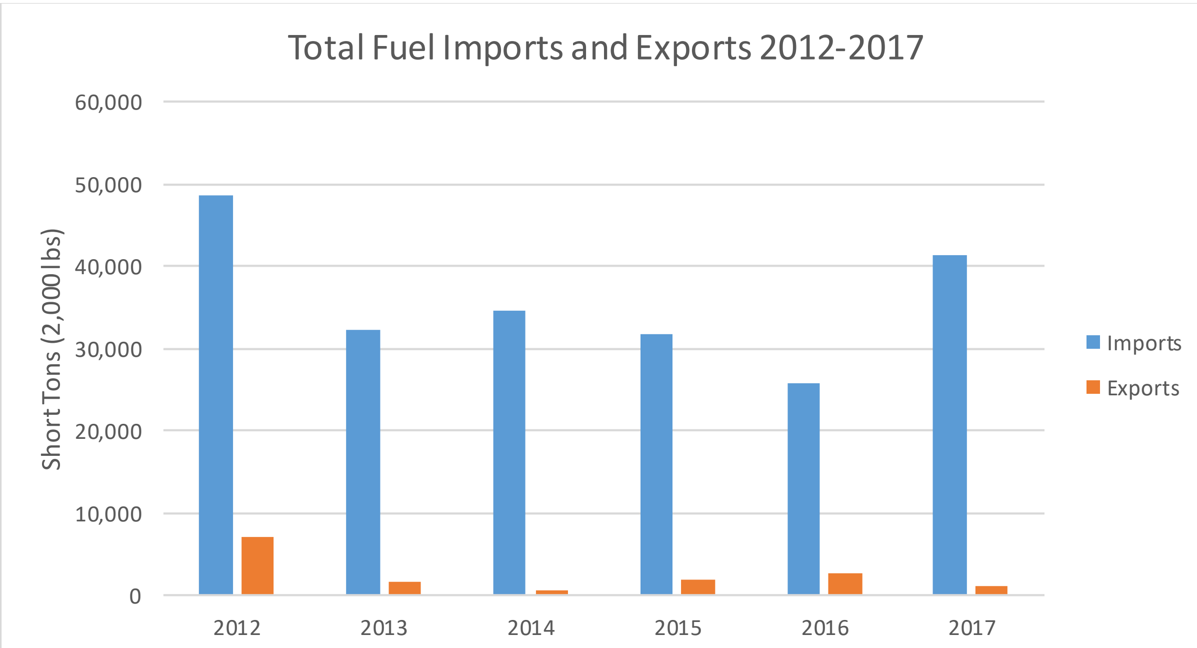

Figure 49. Nome Total Historical Fuel Volumes (short tons) by Direction, 2012 to 2017 (Data Source: Port of Nome Season Commodity Report by Vessel).

3.6.3 Gravel and Quarry Stone

The Cape Nome quarry (12 miles east of Nome) is a source of industrial-grade armor stone and rip rap commonly used on seawalls, causeways, and breakwaters. It can also be crushed for gravel and used as construction material for airport runways and roads. The nearest alternative quarry is located on St. Paul Island, about 1,700 miles from Nome.

Below are the imports and, primarily, exports of gravel and stone from Nome since 2012 (Figure 50). The volumes of gravel and stone shipped any given year can be quite variable, depending on the amount of local and regional construction happening that year (Appendix D, Section 5). In 2016, for example, there was a large project in Hooper Bay, about 180 miles south of Nome. The state conducted extensive relocations and repairs on their airport and its access road. This project accounted for much of that year's volume.

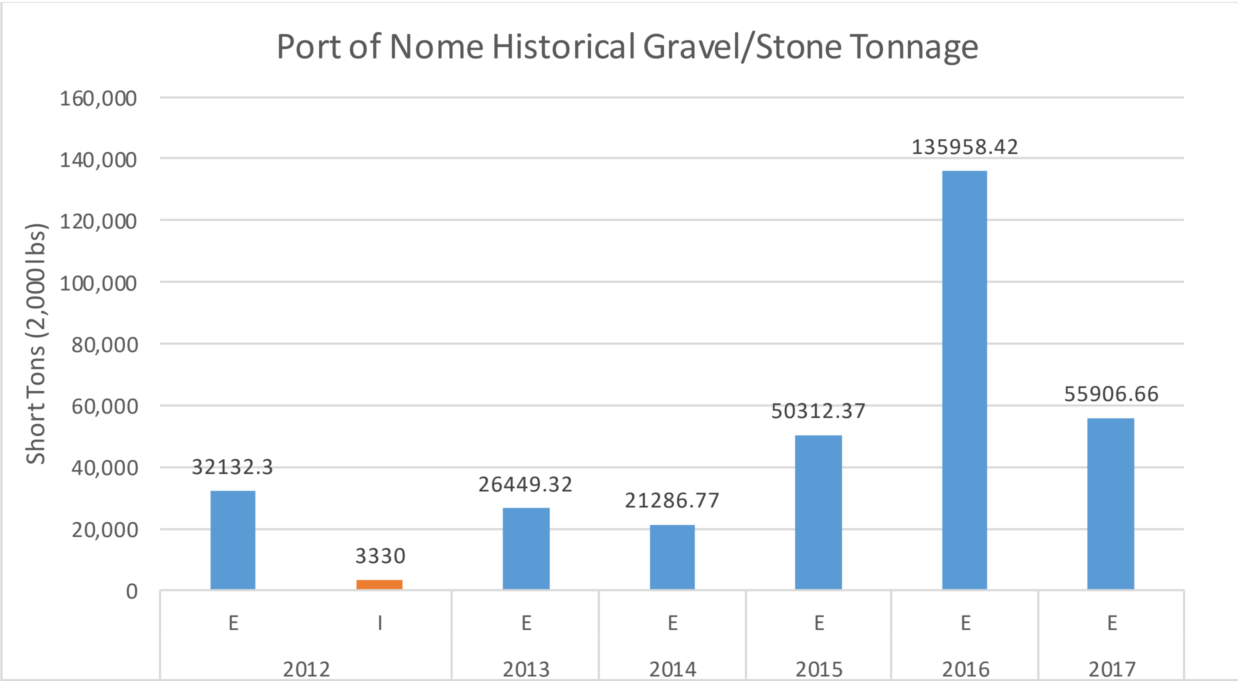

Figure 50. Gravel/Stone Imports and Exports through Nome, 2012-2017 (Data Source: Port of Nome Seasonal Commodity Report by Vessel).

3.6.4 Dry Cargo

All other cargo shipped into and out of Nome is classified by the port as dry cargo or cargo. The volumes of cargo delivered to Nome are for local consumption in Nome as well as transshipped to remote villages along the western Alaska coast. The types of items that are shipped to and from Nome on cargo barges, including containerized cargo and fuel, vehicles, construction equipment, municipal and industrial building materials, windmills, modular/manufactured housing, etc.

Cargo imports and exports have decreased significantly over the last six years (Appendix D, Section 3.6.4). The weather and ice have played their traditional role in minor variations in volumes, but Alaska is also in the midst of a recession. Economic output in Alaska has been on the decline since 2012, but the drop in oil prices in 2015 ushered in steeper declines in output and employment state-wide. The significance of these drops are displayed in Figure 51.

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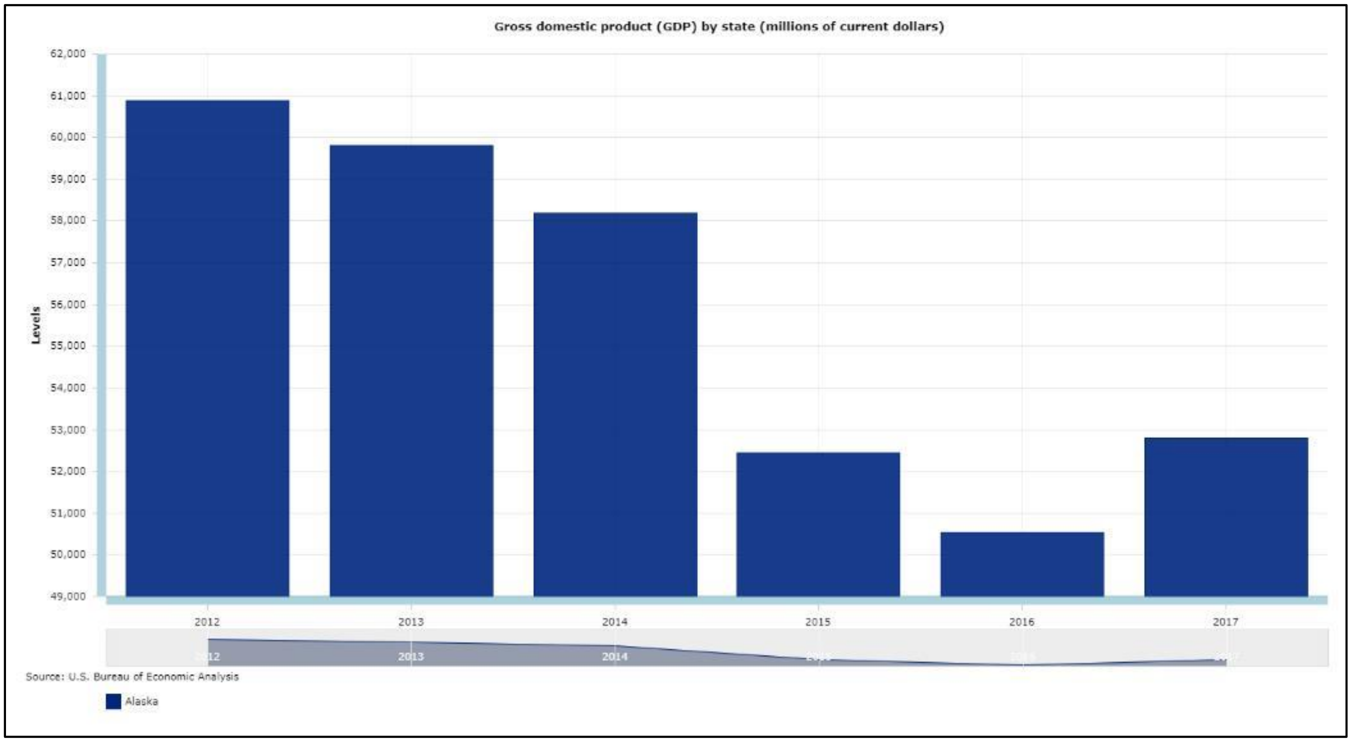

Figure 51. Alaska Gross Domestic Product (million$) from 2012 to 2017.

According to discussions with port personnel, this recession directly impacted regional construction projects such as roads, airports, schools, clinics, and seawalls. Although some work periodically occurred through federal funds, there was a significant drop in the volume of projects due to a very limited source of state funding. The volumes of cargo moved in western Alaska and Nome specifically, reflect these changes, as shown in Figure 52.

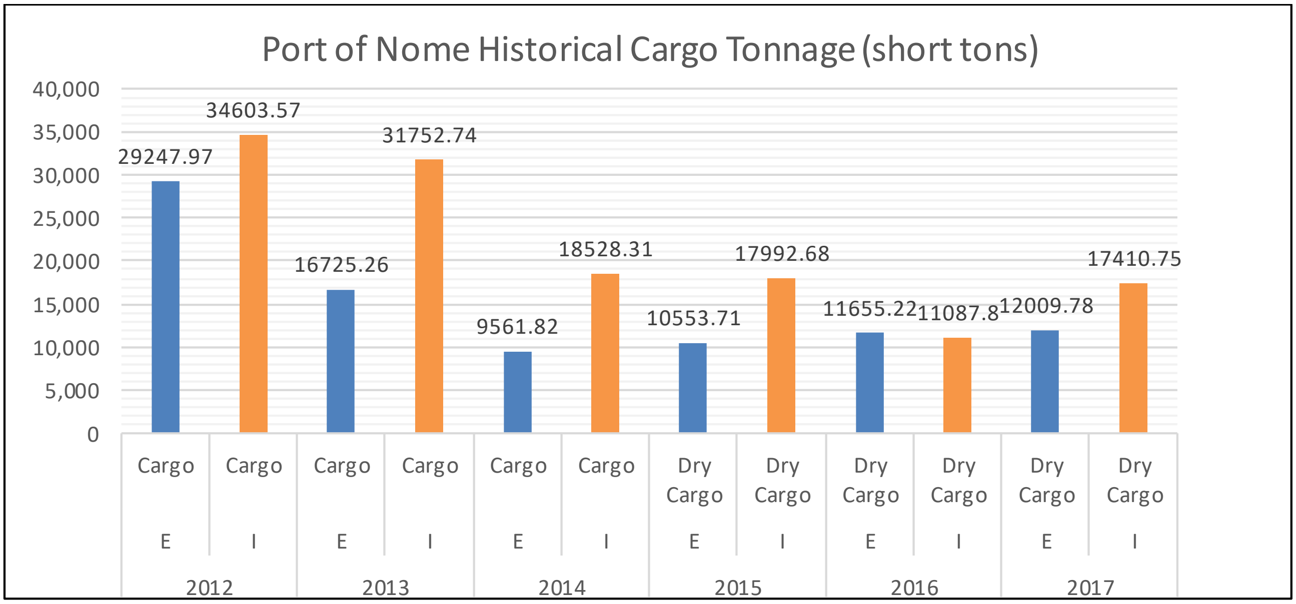

Figure 52. Cargo Imports and Exports through Nome, 2012-2017. (Data Source: Port of Nome Seasonal Commodity Report by Vessel).

3.7 Summary of the Without Project Condition

The FWOP condition utilized for economic analysis is a forecast of the expected vessel fleet to utilize marine facilities at Nome, based on forecasts of commodity transfers (e.g., fuel), and natural resource extraction activities (e.g., gravel, stone, precious metals, and other minerals). The number of transits through the Arctic does not ultimately affect this study's without-project condition; however, the Arctic has become more ice-free during the summer season; as a result, large vessel traffic has continued to grow. Projections from external sources for future traffic indicate that there could be as many as 1,400 transits by 2020.

The greatest impact on the physical environment and biological resources is due to a changing climate that will likely result in diminishing sea ice. As a result, flora and fauna within the study would be negatively impacted.

4.0 FUTURE WITHOUT PROJECT CONDITIONS

4.1 Assumptions

For this study, all non-structural measures that are currently in place are assumed to remain in place over the 50-year period of analysis. The period of analysis is 50 years, beginning with the base year of 2022, the project effective date, to 2072. The FY2020 Federal discount rate of 2.750 % is used to discount benefits and costs. The report uses methodology from ER 1105-2-100, transportation savings accruing to deep-draft vessels.

All vessel lightering and transshipment activities would continue as they currently occur, and vessels that draft more than 18 ft are not likely to call at the causeway docks. Except for what may result from this study, the City is unlikely to modify the Outer Basin and associated navigation channels. However, additional uplands have recently been acquired by the City for future use for cargo storage, vessel overwintering, and potential bulk-fuel storage needs.

Environmental consequences described under the Future Without Project (FWOP) Conditions are the same as those under the No Action alternative.

4.2 Physical Environment

4.3 Climate Change

The climate of the Arctic is changing. Key indicators are the extent, thickness, and duration of Arctic sea ice cover, which could directly affect port operations. The trend of these indicators have progressed steadily downward with record lows for each being experienced on a near-annual basis. The ice-free period appears to be increasing, which could increase the duration of port operations in the future. NOAA recently revised its predictions for ice-free seasons in the Arctic to begin occurring by 2020. This does not mean that the Arctic will be ice-free in winter. However, it does mean that the ice that forms in winter would be single-year ice as opposed to the current multi-year ice. The thinner layers of ice could make navigation throughout the Arctic viable year-round for appropriately designed vessels. Although subject to change as this study progresses, for the without-project condition, a range of 150 days (current condition) to 240 days represents the array of potential open-water conditions.

Temperatures in the Arctic have varied but show a significant warming trend since the 1970s, and particularly since 1995, according to a Congressional Research Service Report dated 04 March 2019 (CRS 2019). Other physical changes in the Arctic include warming soil and melting permafrost. Spring and fall coastal storm waves are more frequently reaching coastlines that are not protected by grounded shore-fast ice. These shoulder season storms impact the shore more severely than in the past resulting in higher coastal erosion rates, especially in areas with thawing permafrost. For example, coastal erosion rates experienced just east of Cape Blossom located about 175 miles north of Nome, increased from an average of 0-1.8 feet per year (ft/yr) from 1952 to 2012, to 17.7 to 30.4 ft/yr from 2012-2018 (USACE 2019b).

Biological changes are also occurring due to climate change with shifting vegetation and animal abundances (CRS 2019). These physical and biological changes are expected to affect traditional livelihoods and cultures in the Arctic. Thawing permafrost impacts existing infrastructure, and this changing condition increases construction costs in order to adapt to the changing site conditions. In severe coastal erosion conditions, whole villages have had to relocate (Newtok, Alaska, and some are listed as sufficiently threatened in the BSNC region that relocation is being considered.

4.4 Biological Resources

Habitat and Wildlife

Habitats in the northern Bering Sea are exhibiting effects from climate change, effects that are expected to expand and intensify in the future. Warming temperatures in the arctic and subarctic are expected to bring about changes in sea ice cover. The timing, distribution, and even thickness of sea ice has a significant effect on primary productivity. Under warm conditions, the sea ice may melt before there is sufficient sunlight to support the massive phytoplankton bloom typically associated with the melting of sea ice and its release of nutrients and entrained microorganisms. The bloom then happens later in the spring and is more heavily exploited by zooplankton and fish, with less of the bloom's biomass descending to the benthic environment. This shift of energy from benthic-centered to pelagic-centered food webs directly affects benthic and benthic-feeding organisms such as crab, walrus, eiders, and several whale species (Smith et al. 2017). This trophic change could be especially profound in the highly benthic-centered Norton Sound.

Protected Species**:**

ESA and MMPA Species

Polar bears, bearded seals, and ringed seals received their listings under the ESA largely in anticipation of adverse effects on these species from changes in sea ice distribution. Ice seals and walrus depend on sea ice at certain times of year for migration, pupping, and other important life events (Smith et al. 2017). Diminishing sea ice cover would likely alter the timing of these events and the overall distribution of the affected species as the ice recedes to deeper waters.

Migratory Birds

Diminishing sea ice cover may initially benefit some surface-feeding birds, but, as suggested above, benthic-feeding birds are likely to be negatively affected by lowered benthic biomass. Warmer oceans and the resulting complex trophic changes have been linked to massive die-offs of murres, puffins, and other seabirds reported in recent years.

Essential Fish Habitat

Local observation and marine research suggest that the composition and distribution of Bering Sea fish species are changing. Reduction of sea ice cover may drive benthic-centered ecosystems like Norton Sound's to become more pelagic-centered (Kedra et al. 2015; Gay Sheffield, personal communication). Several recent studies on walleye pollock in the Bering Sea show that species shifting northward into the Bering Strait region in response to warmer temperatures in the southeast Bering Sea, hundreds of miles from Nome (Duffy-Anderson et al. 2017; Barbeaux 2017). A study of 40 fish and invertebrate species found that the center-of-distribution of those species, including Arctic cod, Pacific halibut, and snow crab, have shifted northward an average of 21 miles in response to changing temperature regimens (Smith et al. 2017). Such shifts in species distribution will have far-reaching effects on other species and ecosystems (Smith et al. 2017; Oceana & Kawerak, Inc. 2014).

Special Aquatic Sites

Eelgrass beds are a “vegetated shallow” under the CWA Section 404(b)(1) definition and are found in sheltered areas of Norton Sound, such as Golovnin Bay. Eelgrass beds may expand in response to warmer temperatures and diminished ice cover. The exposed coast at Nome will continue to be a marginal environment for rooted vegetation, but eelgrass may become established in the relatively sheltered Outer Basin.

4.5 Cultural Resources

Future construction projects or infrastructure development, naturally-occurring coastal erosion, or naturally-occurring organic degradation in the vicinity of the Port of Nome could impact the aesthetic, historical, and cultural resources in the area. However, no specific known major impacts to aesthetic, historical, or cultural resources are expected under future without-project conditions.

4.6 Subsistence Use

People who depend on regional biological resources for subsistence are also affected by changes in sea ice and ecological regimes. Local hunters have seen a landward shift in the average extent of shorefast ice and noted that shorefast ice does not form as reliably in some areas, and is more likely to become unstable and dangerous than in the past. Long lingering ice is reported as thinner and tends to break into smaller pieces that are less useful to migrating marine mammals. Also, changes in fisheries distributions may make valued food resources less plentiful and require more time and effort to gather (Oceana and Kawerak 2014).

4.7 Economic & Political Conditions

4.7.1 Commerce

The FWOP condition utilized for economic analysis is a forecast of the expected vessel fleet to utilize marine facilities at Nome, based on forecasts of commodity transfers (e.g., fuel), and natural resource extraction activities (e.g., gravel, stone, precious metals, and other minerals). The number of transits through the Arctic does not ultimately affect this study’s without-project condition; however, the Arctic has become more ice-free during the summer season, and as a result, large vessel traffic has continued to grow. In 2010, the Arctic saw its first cargo transits of 4 vessel trips, which have grown to over 70 in 2013. Russia began to require permits for foreign vessel transits through the Northern Sea Route, issuing over 600 by October 2014. Though not all of these vessels transport cargo, the data shows that there is a steady and dramatic increase in vessel transits. Projections from external sources for future traffic indicate that there could be as many as 1,400 transits by 2020.

In order to project volumes of commerce into the future, each commodity was examined in detail. All commodity volumes were provided by the port in short tons (2,000 pounds), but the volumes were converted to metric tons for the subsequent analysis. All graphs from this point are in metric tons. Generally, specific commodity studies are of limited value for projections beyond approximately 20 years. Given this limitation, it is preferable to hold the traffic projections constant to the end of project life from the 20-year point.

4.7.2 Fuel Receipts and Shipments

Historical fuel movements were separated into receipts and shipments, given that the volumes for each are significantly different. A baseline volume of fuel receipts was calculated using a ten-year average of the 2008 to 2017 historical import volumes. From there, volumes are forecasted to remain constant for 20 years (Figure 53).

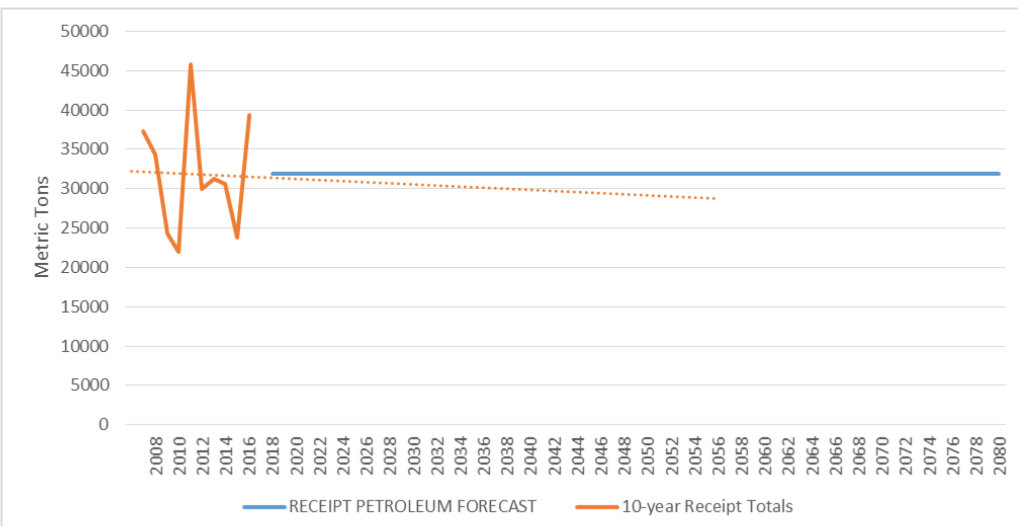

Figure 53. Historical and Projected Fuel Receipts at Nome.

Population growth would put upward pressure on fuel and cargo demand in Nome proper, and on cargo demand in the surrounding region. This would drive refueling needs of the commercial fleet calling on Nome. As a result of these factors, a growth rate of 3.0 % was used as a proxy for fuel export growth over the period of forecast (Figure 54). From there, export volumes are forecasted to grow by 3.0 % a year for 20 years.

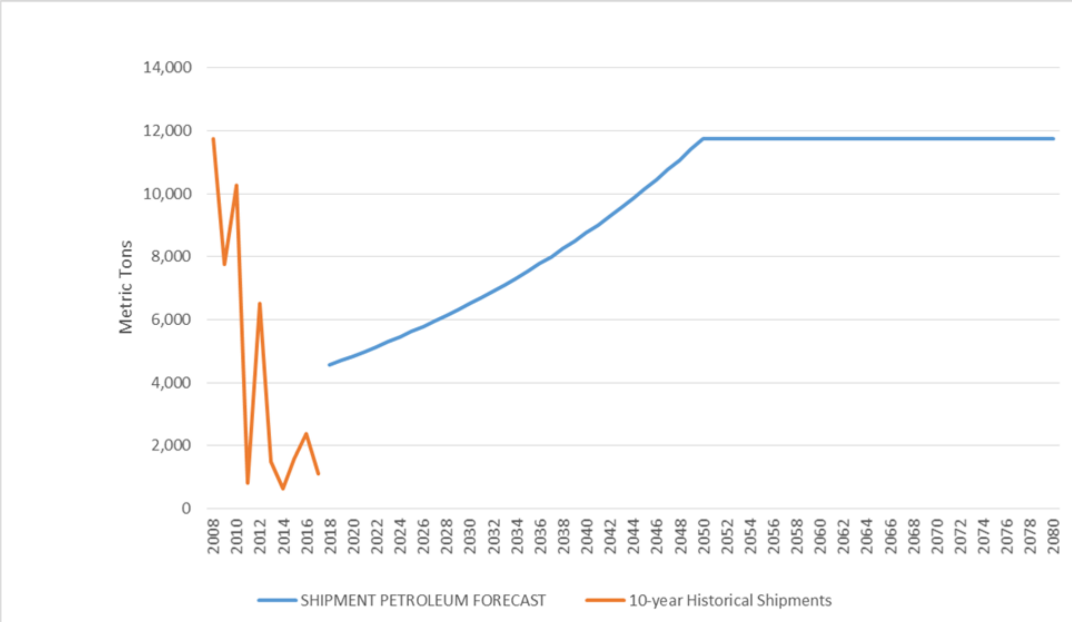

Figure 54. Historical and Future Fuel Shipments of Nome.

4.7.3 Gravel, Stone, and other Minerals

Historical gravel and stone volumes were provided by the port of Nome dating back to 2012 for this study effort. Data from 2008 to 2011 was retrieved from previous port submissions for the 2015 Arctic Deep Draft Ports Study. Gravel and stone movements are export-only, and no imports are expected to appear over the forecast period. A baseline volume of gravel exports was calculated using a ten-year average of the 2008 to 2017 historical export volumes. From there, volumes are forecasted to grow by 0.43 % a year (Figure 55).

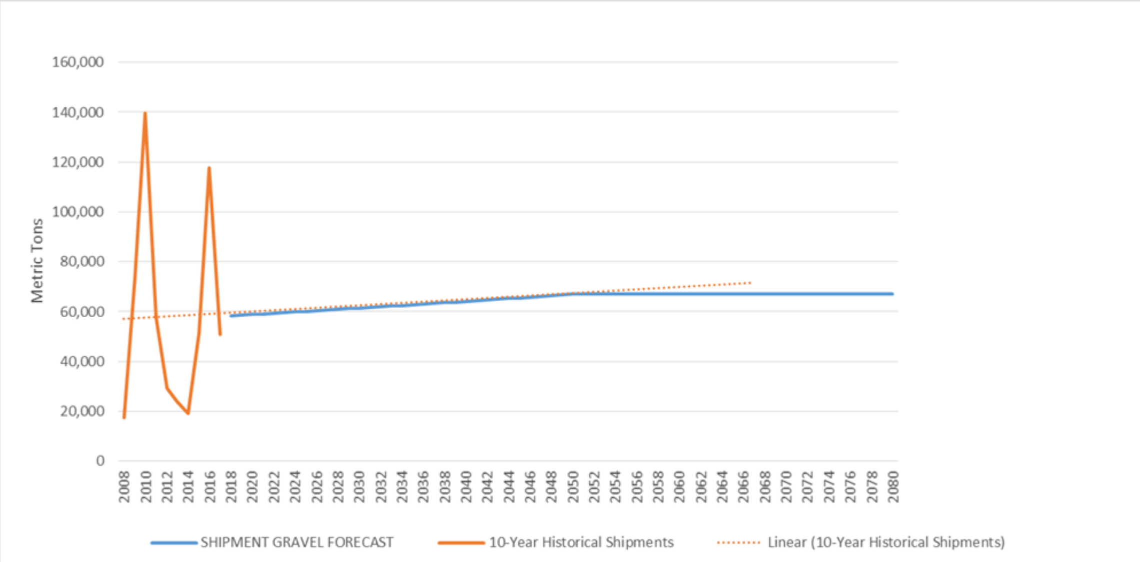

Figure 55. Historical and Future Gravel Shipments at Nome.

One variable that is not in place currently, and may have a significant impact on exports associated with local mining, is the development of the Graphite Creek Project by a company called Graphite One Resources. This proposed mine/refinery project is located about 37 miles north of Nome, and reportedly includes America's highest grade and largest known, large-flake graphite deposit. This project's pre-feasibility and feasibility studies with a construction decision are targeted for 2020. In July 2017, the mining company released its preliminary economic analysis report (PEA), which concluded that the graphite resources have the potential to be economically viable. The PEA assumed a mine life of 40 years shipping 60,000 metric tons per year of graphite concentrate (from the 6th year onwards). The concentrate would be loaded at the mine into containers in one-ton super sacks and transported by truck to the Port of Nome for seasonal loading onto barges. Each container would hold 18 tons of concentrate and have a gross weight of about 20 tons. On this basis, approximately 3,333 containers are shipped annually.

This analysis assumes the graphite would be shipped from Nome aboard cargo barges which already call at Nome. Considering the capacity of these vessels and the expected amount of outbound dry cargo from Nome on each call, there is assumed to be adequate capacity onboard these barges for the expected 3,333 annual additional containers of graphite. No additional barges have been added to future scenarios for mine operations. An updated chart of exports, including gravel, stone, and graphite tonnage from the mine over its 40-year service life, is presented in Figure 56.

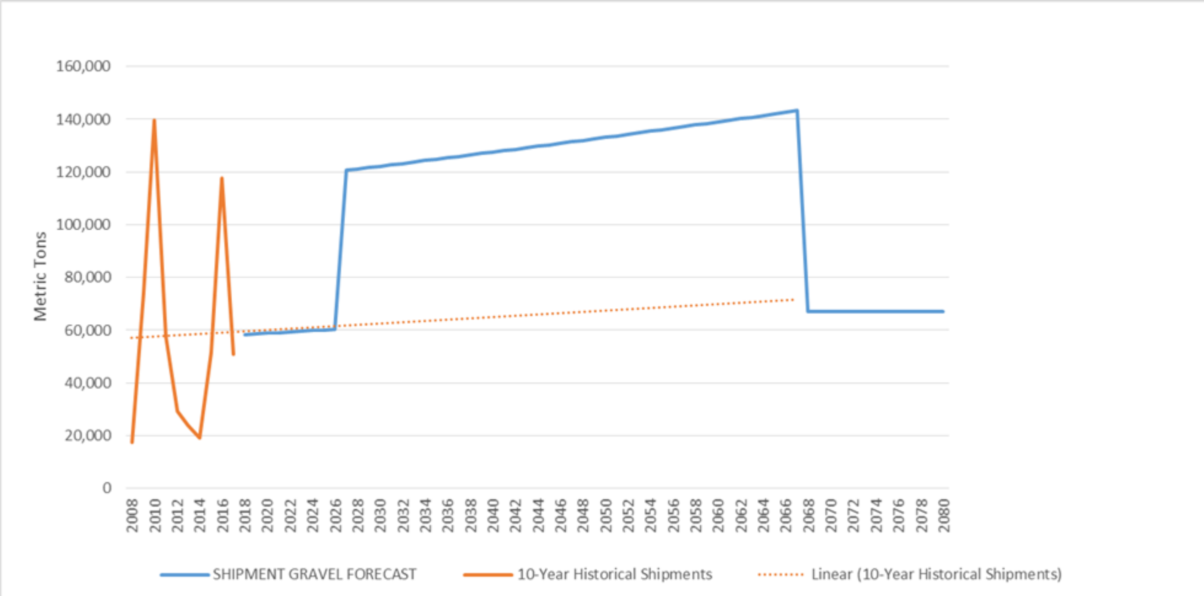

Figure 56. Historical and Future Gravel and Stone Shipments at Nome, including graphite.

4.7.4 Cargo Volumes

Historical cargo volumes were provided by the port of Nome dating back to 2012 for this study effort. Data from 2004-2012 was gathered from USACE's Waterborne Commerce Statistics Center databases as well. Cargo movements were separated into imports and exports, given that the volumes for each are significantly different.

Cargo import volumes in 2017 already began to increase towards more moderate levels, so a positive forecast is not unreasonable. A baseline volume of imports was calculated using a ten-year average of the 2008-2017 historical import volumes. From there, import volumes are forecasted to grow by 0.76 % a year for 20 years (Figure 57). Cargo exports are assumed to behave in a similar manner. Volumes in 2016 showed an increase towards more moderate levels, so a positive forecast is not unreasonable (Figure 58). The positive population growth in the Nome Census area was a reasonable proxy for export growth in this scenario. A baseline volume of exports was calculated using a ten-year average of the 2008-2017 historical volumes. From there, volumes are forecasted to grow by 0.76 % a year for 20 years.

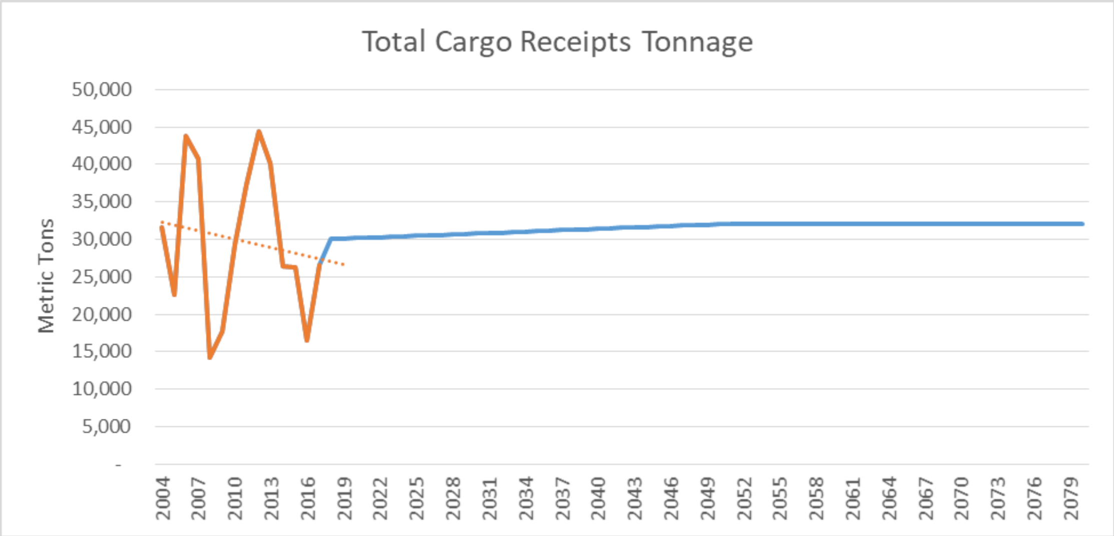

Figure 57. Historical and Future Cargo Receipts at Nome.

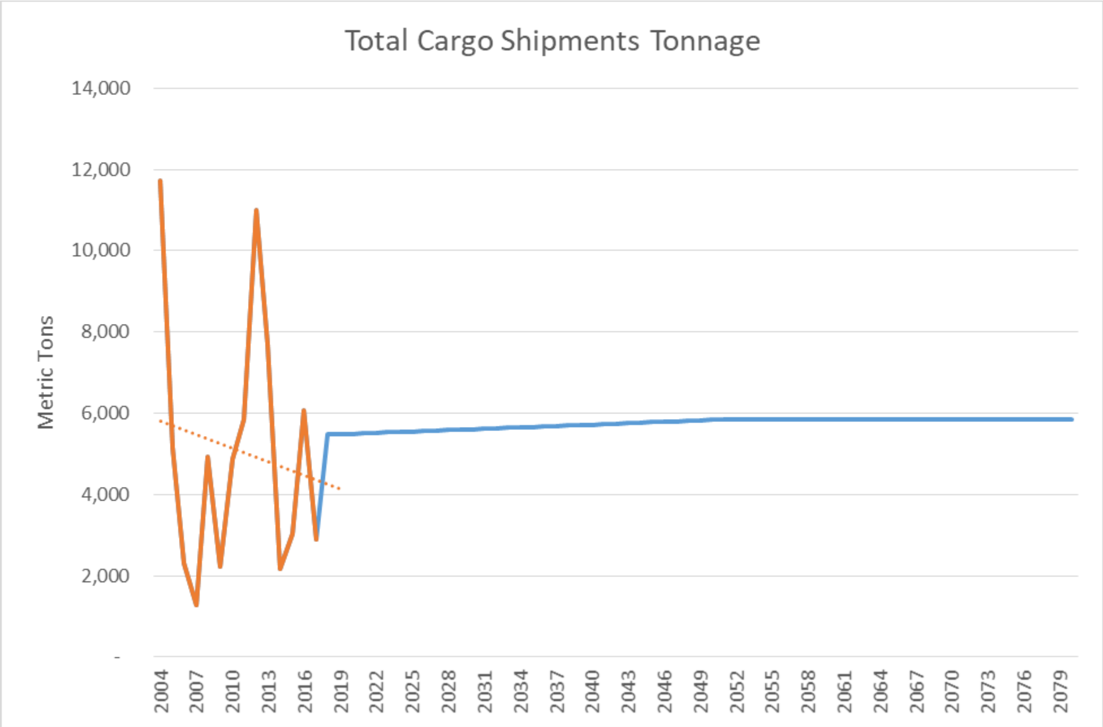

Figure 58. Historical and Future Cargo Shipments at Nome.

4.8 Vessel Traffic

The vessel fleet calling on the Port of Nome in the FWOP condition is assumed to grow with the natural increases in global shipping over the forecast period. Arctic shipping is forecasted to follow the increasing trend of global economic growth, and regional population growth would also drive the need for increased levels of cargo shipped in the future.

Typically, a three-year historical vessel call list is used in navigation studies to create a baseline for future vessel forecasts. This study continued using this process in order to capture the upper potential limit of increased traffic (in 2016) and two additional years of steady traffic. This approach best captures the variability present in Nome traffic from year to year.

A three-year average, using the totals from 2015 to 2017, was used to calculate the estimated number of vessel calls, by class, for the 2018 season (Table 14). Those estimates are shown in the table below as compared to the totals from each of the previous three years. These totals include vessels that anchored off-shore of Nome to conduct re-supply or transfer fuel, as they were too large to call inside the Outer Basin.

Table 14. Historical and Projected Calls at Nome by Class

Year	2015	2016	2017	2018(est)
Vessel Class	**Number of Calls**	**Number of Calls**	**Number of Calls**	**Number of Calls**
Buoy Tender	2	1	2	2
Cutter	8	4	10	8
Ice Breaker	4	3	4	4
Large Cruise Ship	0	1	1	1
Large Landing Craft	33	34	43	37
Large Research Vessel	0	2	2	2
Large Tug & Barge	16	18	16	17
Medium Cruise Ship	3	3	3	3
Medium Research Vessel	9	6	17	11
Medium Tug & Barge	51	44	40	45
Miscellaneous	10	44	17	24
Small Landing Craft	1	3	1	2
Small Research	29	12	16	19
Small Tug & Barge	47	62	67	59
Tanker	11	11	9	10
Tugboat	5	6	2	5
Grand Total	**229**	**254**	**250**	**249**

Next, the future vessel fleet was forecasted by conducting a load factor analysis for each vessel class and each commodity that they moved through the port. This analyzes how fully loaded each vessel was when it imported or exported a certain commodity. There is no reason to suspect that vessels would alter the ways in which they load goods in the future without-project condition. In discussions with the various shippers that use the port of Nome, none have indicated a pending shift to larger or different kinds of vessels. Low population growth and historic demand for fuel and cargo lead indicate that the current fleet is sufficient for the foreseeable future. There is currently no new technology on the horizon that could alter the way these vessels operate. The International Maritime Organization (IMO) is debating the use of certain types of fuels in the Arctic region. These fuels include types of heavy fuels and high-viscosity oils used in larger commercial shipping fleets. These fleets are currently making plans to install conversion equipment on existing vessels and build new vessels that no longer require heavy fuels. However, the fleet currently calling on Nome does not use these heavy fuels to operate. They use marine diesel or gasoline to operate their propulsion and auxiliary systems, so these rule changes would not drive vessel changes in this scenario.

Once this analysis was completed for each class, and each commodity, total numbers of vessel calls were estimated over the 50-year forecast period. Similar to the commodity forecasts, after the initial 20-year period, growth was held constant for the remaining 30 years. So, the level of vessels in 2040 to 2070 would remain unchanged (Table 15).

Table 15. Future Without-Project Vessel Fleet Calling at the Port of Nome by Class and Year

Vessel Class	2030	Vessel Class	2040	Vessel Class	2050
Small Tug & Barge	67	Small Tug & Barge	83	Small Tug & Barge	104
Medium Tug & Barge	41	Medium Tug & Barge	52	Medium Tug & Barge	62
Large Tug & Barge	27	Large Tug & Barge	31	Large Tug & Barge	37
Tanker	18	Tanker	22	Tanker	29
Tugboat	0	Tugboat	0	Tugboat	0
Cutter	14	Cutter	19	Cutter	26
Buoy Tender	2	Buoy Tender	3	Buoy Tender	4
Ice Breaker	2	Ice Breaker	8	Ice Breaker	10
Large Cruise Ship	1	Large Cruise Ship	2	Large Cruise Ship	2
Medium Cruise Ship	8	Medium Cruise Ship	10	Medium Cruise Ship	13
Small Research Vessel	27	Small Research Vessel	36	Small Research Vessel	49
Medium Research Vessel	20	Medium Research Vessel	26	Medium Research Vessel	35
Large Research Vessel	2	Large Research Vessel	3	Large Research Vessel	4
Small Landing Craft	3	Small Landing Craft	3	Small Landing Craft	4
Large Landing Craft	26	Large Landing Craft	32	Large Landing Craft	38
Miscellaneous	29	Miscellaneous	39	Miscellaneous	52
Total	**287**	**Total**	**369**	**Total**	**469**

Based on the existing vessel fleet calling on Nome, route groups were established to capture the general distances traveled by vessels at sea on their typical trips to and from Nome. These routes help estimate the operating costs of different vessel classes in the without-project condition. The number of vessel calls to Nome in the without-project condition over the forecast period is presented in Table 16.

Table 16. FWOP Vessel Calls by Route Group

Route Group	Years			
	2030	2040	2050	2079
Bering Sea Cruise[1]	7	10	12	12
Bering Sea Patrol[2]	18	30	40	40
Bering Sea Research[3]	49	65	88	88
FE Tanker Route[4]	18	22	29	29
Nome Service Area[5]	132	167	209	209
WCUS-Nome[6]	63	76	91	91
Total	**287**	**369**	**469**	**469**

Notes:

1) Bering Sea Cruise: Based on cruise ship schedules: Origin & destination Canada and stops in Russian, Canadian, Alaskan and Scandinavian Arctic.
2) Bering Sea Patrol: Based on sailing routes of the U.S. and other government vessels: Originate in Cordova, Homer, or Kodiak and sail as far North as Barrow.
3) Bering Sea Research: Based on sailing routes of research vessels: Origin & destination after Nome anywhere from South Korea to Port Clarence.
4) FE Tanker Route: Far East Tanker Route: Origin & Destination South Korea. Anchored at Nome, Nunavak, St. Lawrence, and Togiak Bay during voyage.
5) Nome Service Area: Transshipment services from Nome: Originate in Nome and stop in several Alaskan communities before returning to Nome; Communities range from as far north as Barrow and as far south as Platinum.
6) WCUS-Nome: West Coast US to Nome: Origin & destination in Seattle or Tacoma and stop in several Alaskan communities before or after arriving in Nome. Ex: Seattle, Seward, Bethel, Nome, Kotzebue, Naknek, Dillingham, Seattle.

4.9 Planned Development (With Implications for this Project)

The fuel storage facilities at Nome have sufficient capacity at their respective locations for the amount of fuel moved in and out of the port at this time. However, future volumes of fuel would likely require an increased level of land-based storage in the FWOP condition. Since existing petroleum operators are already preparing for storage expansion, it is safe to assume that the existing storage would be expanded as demand dictates, and without consideration to project alternatives.

4.10 Summary of the Without Project Condition

The FWOP condition utilized for economic analysis is a forecast of the expected vessel fleet to utilize marine facilities at Nome, based on forecasts of commodity transfers (e.g., fuel), and natural resource extraction activities (e.g., gravel, stone, precious metals, and other minerals). The number of transits through the Arctic does not ultimately affect this study's without-project condition; however, the Arctic has become more ice-free during the summer season, and as a result, large vessel traffic has continued to grow. Projections from external sources for future traffic indicate that there could be as many as 1,400 transits by 2020.

The greatest impact on the physical environment and biological resources is due to a changing climate that will likely result in diminishing sea ice. As a result, flora and fauna within the study would be negatively impacted.

5.0 FORMULATION & EVALUATION OF ALTERNATIVE PLANS*

5.1 Plan Formulation Rationale

Plan formulation is the process of building alternative plans that meet planning objectives and avoid planning constraints. Alternative plans are a set of one or more management measures functioning together to address one or more planning objectives. A management measure is a feature or activity that can be implemented at a specific geographic site to address one or more planning objectives.

5.2 Plan Formulation Criteria

Alternative plans were formulated to address study objectives and to adhere to study constraints. Each alternative plan shall be formulated in consideration of the national criteria noted in Section 2.7: completeness, efficiency, effectiveness, and acceptability.

5.3 Management Measure Development

5.3.1 Structural

Structural measures were initially proposed during open discussions at the charrette, with a few identified during project delivery team (PDT) meetings (e.g., concrete caisson dock design). These measures are listed below:

- In-Water Breakwater/Causeway Structures
- Causeway – rubble mound
- Breakwater – rubble mound
- Bridge(s)
- Trestle with road (pile or closed-cell sheet pile supports)
- Dock Design
- Caisson (concrete) docks
- Steel sheet pile docks
- Ship to Shore Fuel Off-loading
- Marine header/pipeline and other utilities
- Lightering to smaller vessel that can enter port
- Single-point off-shore moorage with marine header and fixed seafloor pipeline
- Single-point off-shore moorage with marine header and seasonal or temporary pipeline
- Increase land-based bulk fuel storage
- Relocation of Port to Another site

5.3.2 Non-Structural

Management measures (measures) for this study were initially developed during the April 2018 charette and discussed in more detail in subsequent PDT meetings. In addition, the non-Federal sponsor provided the list of non-structural measures listed below that are currently applied to manage port congestion.

- Creative navigation/mooring options
- Prioritizing vessel operational needs
- Revisions made to the Port of Nome Strategic Development Plan (PONSDP) to address congestion/delays
- Vessel rafting
- Time constraints on dock access
- Usage of new areas for shore access
- Provide fuel by air

While the non-structural measures are an attempt by the port operators to manage the congestion, they do not meet the planning objectives; if they did, then there would not be problems that warrant a study.

Non-structural measures identified during the charette included:

- Dredging
- Aids to navigation
- Emergency sirens
- Sectioning harbor areas
- Modify moorage rules to increase safety and decrease risks
- Coordinated vessel delays to relieve congestion

Of the 5 non-structural measures identified above, the first two, dredging and aids to navigation are carried forward for this study. The non-Federal-sponsor confirmed the others are already implemented in the existing harbors and will be revisited and modified as applicable by the non-Federal sponsor after the proposed modifications to the existing harbor are in place. Aids to navigation are coordinated with the USCG as discussed in Chapter 7.0. Dredging material management options considered for this study are evaluated as a separable element with the selected option or options applicable to each plan alternative. In other words, each alternative plan carried forward for evaluation in this study will manage the new work and annual maintenance dredged material in the same way for the purposes of selecting plan. Coordinating vessel traffic already an active practice to manage congestion. This practice does not allow deeper draft vessels to use the port or increase navigation efficiency.

5.4 Measure Screening

5.4.1 Structural

Measures were initially proposed and evaluated during open discussions at the charrette. The measures were initially identified by the participates in an open discussion and again in multi-disciplinary groups made up of stakeholders, city and port personnel, USACE staff, and other interested parties that attended the charette. During the group exercise, each group developed alternative plans considering the initial array of measures identified in the open discussions and any new ones they may have identified as a group. The alternative plans developed by each group were then discussed in an open discussion that carried some plan concepts and screened out others. This measure and plan development process naturally screen out some of the ineffective measures and plans because of the experience of the charette attendees tended to identify what worked and did not work with the current operations. After the charette, the PDT then evaluated the measures and alternative plans further while developing the initial alternative plan concept drawings based design standards and other engineering considerations.

This section presents the screening rationale for structural measures (Table 17) and for the dredging measures (Table 18) for the measures identified during the charette and those that may have been identified and evaluated by the PDT after the charette.

Table 17. Initial Structural Measures Screening Rationale

Measure Description	Comments	Carried Forward (yes/No)
In-Water Breakwater/Causeway Structures		
Causeway – rubble mound	A proven design in arctic conditions at Nome. This design provides wave, wind, and ice protection. This solid structure does interrupt long-shore currents and the west–east sediment migration, and fish and marine mammal passage.	Yes
Breakwater – rubble mound	Same comments as Causeway – rubble mound	Yes
Bridge(s)	A bridge is built in to the existing west causeway and any new causeway would have a similar structure to reduce the impact to currents, sediment transport, and fish and marine mammal passage.	Yes
Trestle with road (pile or closed-cell sheet pile supports)	Design does not provide wave, wind, and ice protection. Less impact to longshore current, sediment migration, and fish and marine mammal passage.	No
Dock Design		
Caisson (concrete)	Caissons was the initially selected dock design by the PDT; however, depth limitations, high cost, and availability/implementation concerns resulted in the selection of a sheet pile design for all plans.	No
Steel sheet pile (modified diaphragm)	Similar to design in current causeway and lower cost than caisson design with fewer construction sequencing concerns.	Yes

	The noise generation expected during construction did elevate the impact determination on ESA/MMPA marine mammal species.	
Ship to Shore Fuel Off-loading		
Marine header/pipeline and other utilities	The non-Federal sponsor and stakeholders believed that a port modifications that could attract larger deep draft vessels in to the port to off-load fuel to land based storage was key to providing benefits to the community and region. If the port modifications achieve this, a new marine header and pipeline, and other utilities will be constructed to service these operations. These LSF feature are a 100 % non-Federal sponsor cost that would built in the Future with Project condition. These LSF features do not influence plan selection.	yes
Lightering to smaller vessel that can enter port	The larger tankers that cannot enter the Port of Nome, or chose not to, anchor beyond the 3-mile limit to transfer fuel to smaller vessels that can enter the Port of Nome or other smaller regional ports to deliver fuel. This is a current and FWOP condition that the port modifications are intending to reduce or eliminate so fuel can be transferred in to Nome to land-based storage more efficiently with less environmental risk during fuel transfer operations.	No
Single-point off-shore moorage with marine header and fixed seafloor pipeline pipeline	The larger tankers that cannot enter the Port of Nome, or chose not to, could use a moorage point beyond the 3-mile limit to transfer fuel via seafloor pipeline to Nome. This measure was not considered because the moorage point would have to be robust to handle wave and ice conditions and may be a hazard to navigation. In addition, the pipeline length of about 3 miles would be extensive and potentially subject to damage by vessel anchors. In addition the seafloor pipeline would cross state waters and areas designated for resource extraction by gold dredges, which would require extensive consultation with the State of Alaska agencies to permit.	No
Single-point off-shore moorage with marine header and seasonal or temporary pipeline	This measure was not carried forward for many of the same reasons as the fixed seafloor pipeline with the added issue of creating a hazard to navigation when the pipeline is on or near the water surface when deployed. In addition, seasonal storage and maintenance of a 3-mile seasonal pipeline would be problematic.	No
Increase land-based bulk fuel storage	This measure is a local service facility measure that it is not part of any particular plan or does it influence any plan so it is not carried forward. However, the stakeholders that own land-based bulk-fuel storage tanks in Nome are considering facility expansions if this project is constructed. They already have land designated for this purpose and can update storage volumes, as needed over the project life.	No

5.4.2 Non-Structural - Dredging

A key measure applicable to each alternative plan is dredging to deepen and maintain navigation channels. For the purpose of the study, the dredge measures or management options considered for this project vary for removing, transporting, and placing/ disposing of the sediments. USACE and non-Federal sponsors experience with the existing port to initially create and maintain navigation channels shows that the management options may not be consistent for the new work and annual maintenance dredge operations. The consistency of the sediments encountered during new work are more dense and contain cobles and boulders, and considering the equipment available in Alaska, the new work dredging would likely be performed using mechanical means (clamshell operation) with a scow barge to transport the sediment to a placement/disposal area. On the other hand, the annual maintenance operation is typically performed using a hydraulic dredge with a vacuum hose to remove the loss sand that typically accumulates annually. The captured sediments are pumped through a pipeline to its destination, which for Nome is a discharge point on the beach just west of the existing sea wall in front of the city. At this point the slurry creates a pit in the beach with the slurry exiting a channel that discharges in to the sea. This has process has extended the beach further out in to the water in front of the west end of the seawall. This beach is enjoyed by the public as a place to beach comb. A summary of the dredging methods and material management options with screening rationale/comments that influenced what was carried forward is presented in Table 18.

Table 18. Initial Dredging Measures Screening Rationale

Measure Description	Screening Rationale/Comments	Carried Forward (yes/No)
New Work Dredging Methods		
Mechanical & Scow	Previous new work dredge experience in the area shows this methodology can successfully dredge the sediment type that would be encountered. The sediment consistency and relatively high percent of expected cobbles/boulder content hampers hydraulic dredging methods currently available in the region. A scow would allow for flexibility when transporting the dredged material for placement or disposal.	Yes
Hydraulic & Pipeline	Contractor may consider using this methodology for some of the work, but the cobble/boulder content and density of the sediments could hamper production and the distance sediment could be pumped may be a limiting factor.	No
Maintenance Dredging Methods		
Mechanical & Scow	Typically more expensive when compared to hydraulic dredging, and not likely needed based on previous annual maintenance dredging experience.	No
Hydraulic & Pipeline	A proven method for annual maintenance dredge operations at Nome, at less cost than mechanical dredge operations. Pumping the dredged material directly to the beach has been an accepted and successful practice that helps build the beach to provide some beneficial use.	Yes
Dredged Material Management Options		
Nearshore Placement	Least cost option for new work dredge material within a currently permitted area within the 3-mile limit. This option has a potential beneficial use of building the beach in front of the sea wall, This	Yes

	placement area could be considered for annual maintenance dredging but it is not the current practice. Offshore berm placement is considered the most compatible beneficial use for mixed sediment types containing silt/sand/gravel/cobbles that is would be generated for the new work dredge (EPA 2007).	
Direct Placement on Beach	Not is not considered compatible for mixed sediments that would be generated during new work dredging but the sand generated during maintenance is compatible for direct beach placement (EPA 2007). Current annual maintenance dredging practice using hydraulic dredging techniques with the benefit of building beach in front of the west end of the City's sea wall. Expected to be more costly for new work dredging because the increased handling cost to transfer the dredged material from the scow to the beach.	Yes
Off-Shore Disposal past the 3-mile limit	Viable option for both new work and maintenance dredging, but has added cost for scow travel to off-shore disposal area, and permit requirements for a new disposal area. There is no known beneficial use of the dredged material if this disposal option is used.	Yes
Off-Shore Disposal within the 3-mile limit	Viable option for both the new work and maintenance dredging, but has added cost for scow travel to off-shore disposal area, although less cost than the disposal area past the 3-mile limit. There is no known beneficial use of the dredged material if this disposal option is used and although the area is currently permitted, the regulatory agencies indicated the material should be placed in the depth of closure; which his essentially the nearshore placement option discussed above. Deeper water disposal options might interfere with off-shore mineral right leases by the State of Alaska.	No
On-land Reuse as Fill	Reuse of dredged sediment from the Inner Harbor Basin has been successfully done in past by the City for new work dredging outside the Federal limits; however, the relatively large volume of new work dredge quantities and additional handling cost to implement makes this option impractical and not cost effective due to the high cost to handle the material multiple times before placement. The reuse option was not considered for the annual maintenance dredging operation for the Outer and Deep Water basins because it was assumed not cost effective. There may also be additional permitting requirements for land based applications than in-water placement.	No
Combination of above options	The dredge contractor may consider the alternative above or other options, but for the purposes of plan selection only those dredge management options carried forward were considered further for this study.	No

5.4.3 Measures Carried Forward

Structural measures that passed the initial screening during the charette were all carried forward through the evaluation and analysis phase. As discussed in the section above, initially measures were qualitatively evaluated by those attending the charette and subsequently during various project team meetings by considering the planning objectives and criteria associated with completeness, effectiveness, efficiency and acceptability. Except for dredging and navigation aids, none of the non-structural measure were carried forward because they did not meet the planning objectives and criteria given site conditions, or they were already being considered or being implemented by the non-Federal sponsor at this time.

The measures carried forward are listed below

- Causeway – rubble mound
- Breakwater – rubble mound
- Bridge(s)
- Docks (modified diaphragm steel sheet pile design)
- Marine header/pipeline and other utilities
- Dredging
- Extend utilities

The measures listed directly above provide the basic building blocks for development of each alternative plan for navigation improvements that modify the existing Outer Basin and create a new Deep Water Basin. Since the Outer Basin has a maximum dredge limitation of -29 ft MLLW to avoid impacts to the existing sheet pile docks in the West Causeway; a new Deep Water Basin was considered necessary to accommodate deeper draft vessels that currently have to lighter fuel and goods in and out of the port. Besides fuel and cargo vessels, the larger cruise ships that visit Nome also lighter their passengers/tourists in and out of the port. Dredging and dredged material management options apply to both basins and are evaluated as separable element.

The measures carried forward as they apply to the existing Outer Basin, new Deep Water basin and dredged material management are presented in Table 19.

Table 19. Measures Carried Forward

Outer Basin Measures Considered

- Modify breakwater and / or west causeway to increase entrance width by
- Add more dock space to west causeway for berthing
- Extend existing east breakwater to deeper water
- Convert portion or all of existing east breakwater to a causeway with docks
- Remove existing east breakwater and add a new structure (breakwater, breakwater/causeway combination, or all causeway) further east aligned with F-Street
- Add a dock or docks to the new east causeway or breakwater/causeway combination aligned with F-Street
- Deepen basin from -22 ft MLLW to a depth no deeper than -29 ft MLLW due to constraints by the existing sheet pile west causeway dock design (evaluated depths of -25 and -28 ft MLLW as separable elements)

New Deep Water Basin Measures Considered

- Extend existing west causeway with dock(s) to deeper water
- Dredge Deep Water Basin to a depth of greater than -28 ft MLLW, turning basin, and entrance channel as needed for design vessel (evaluated depths of -30 , -35 and -40 ft MLLW)
- Extend utilities to service the deep water basin causeway (fuel marine header, water, sewer with associated piping, and electrical service)
- Detached breakwater orientated east-west in deep water

Dredged Material Management Options

- Nearshore placement within the depth of closure east of the existing port in front of the city seawall to provide potential beneficial use
- Direct beach placement east of the existing port in front of the city sea wall as is current USACE practice for the annual maintenance dredged material that is hydraulically dredged
- Off-shore disposal beyond the three-nautical-mile boundary line that has traditionally separated state and federal waters

5.5 Preliminary Alternative Plans

Since no single measure could stand alone as a complete alternative plan and still meet the study-specific objectives, the PDT combined measures to develop the alternative plan concepts that came out of the charette. An array of alternative plans were formulated and assigned for evaluation by multi-disciplinary groups created during the charette. Each group then reported out refinements to these plans and received feedback from the other groups on ways to incrementally improve the various plans. After the charette, this preliminary list of alternative plans were subsequently evaluated further by the PDT during the evaluation and analysis phase, and before and after the Alternative Meeting Milestone Meeting. This resulted in an initial array of 13 alternative plans, not including the Alternative 1, No Action (Table 20 and Figure 59 through Figure 68).

The PDT reduced the preliminary list for further analysis screening because the plans did not increase the entrance to the Outer Basin, and/ or did not provide adequate wave protection from various wind directions (Table 20). Additionally, if these plans were altered to improve wave protection, these plans essentially became similar to the other plans listed and were not carried forward. As result, 7 plans were carried forward as a reasonable array of alternatives for further analysis. Some of the plans were the same configuration and size (Alternatives 3a, 3b, and 3c), but were considered separate plans because the number of docks varied for each.

Table 20. Initial Alternative Plans

Alternative Numbers	Carried Forward	General Description of Modification[(1)] (Includes a reference to Concept Drawings available for each Alternative Plan[(2)])
1	Yes	No Action
2a & 2b	No	2,150 ft long L-Shaped West Causeway extension to approximately the -35 ft MLLW bottom elevation and with one (2a) or two docks (2b) in the Deep Water Basin (Figure 59 and Figure 60). These alternatives are screened out because they do not increase the entrance width to the existing Outer Basin
3a, 3b, and 3c	Yes	2,340 ft long L-Shaped West Causeway extension to the -30 ft MLLW bottom elevation and modify East Breakwater (Figure 61, Figure 62 and Figure 63) with the number of docks differentiating between each alternative; 3a has 3 docks, 3b has 2 docks, and 3c has 1 dock).
4a	Yes	Similar to Alternative 3a-3c, except a Portion of the East Breakwater is Converted to a combination causeway/breakwater aligned along F Street (see Figure 64)
4b	No	The only difference from Alternative 4a to 4b was the latter included a small boat harbor in the outer Basin. This feature was rejected by the PDT so this alternative was not carried forward.
5	No	Remove East Breakwater and relocated further east aligned with F-Street (Figure 65). This alternative screened out because it does not protect the harbor entrance from south wind generated waves which hampers navigation and berthing.
6	No	Detached breakwater in front of Outer Basin and straighten east breakwater (Figure 66) This alternative screened out because to be protective of Outer Basin from wind and waves it creates an entrance navigation challenge for larger vessels that would have to access the harbor from the east or west exposing the side of the vessel to the predominantly south winds. This alternative also does not allow a significantly deeper basin because of the depth restriction of -29 ft MLLW in the Outer Basin does not meet most objectives, a

		separation of on-industrial and industrial traffic, and limits the number of space available for new docks.
7a & 7b	No	2,900 to 4,100 ft long West Causeway extension, remove East Breakwater, and construct a new East Causeway aligned with F-Street (No associated Figures included). These alternatives screened out because they did not increase the entrance channel to the Outer Basin. Alternative 7a, with no "L"-shape also offered limited, if any, protection from south and east winds.
8a & 8b	Yes	3,937 ft (Alt. 8a) to 3,484 ft (Alt. 8b) West Causeway extension to approximately the -45 ft MLLW (Alt 8a) or -40 ft (Alt 8b) bottom elevation, remove East Breakwater, and construct new East Causeway aligned with F-Street (Figure 67 and Figure 68). Alternative 8b added to have a smaller Deep Water Basin than Alternative 8a (the largest plan), yet larger than the other alternatives carried forward

(1) Note: All the alternatives include additional docks and dredging, except the No Action Alternative.
(2) Concept drawings not available for Alternatives 7a and 7b

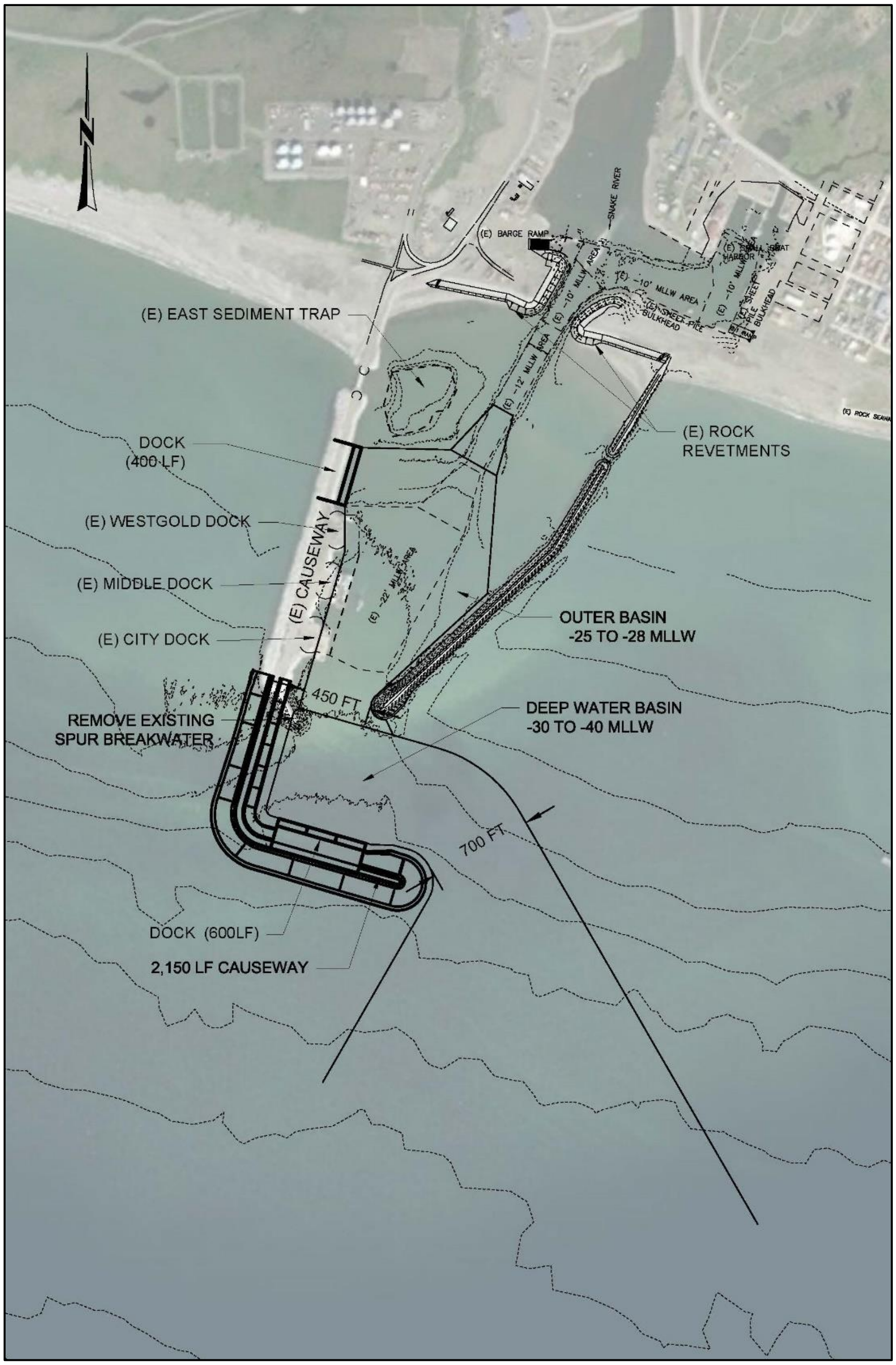

Figure 59. Concept Drawing - Alternative Plan 2a

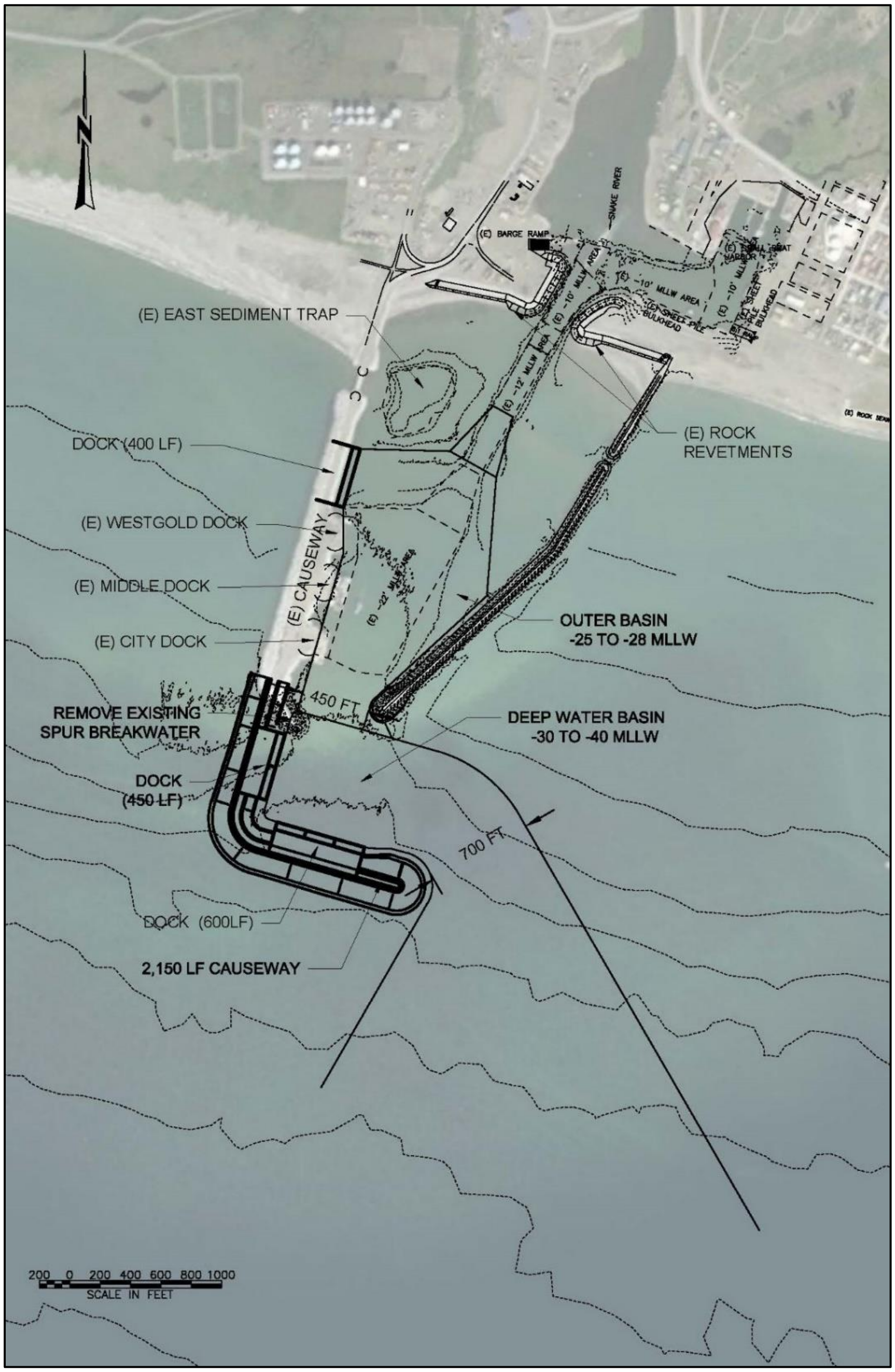

Figure 60. Concept Drawing - Alternative Plan 2b

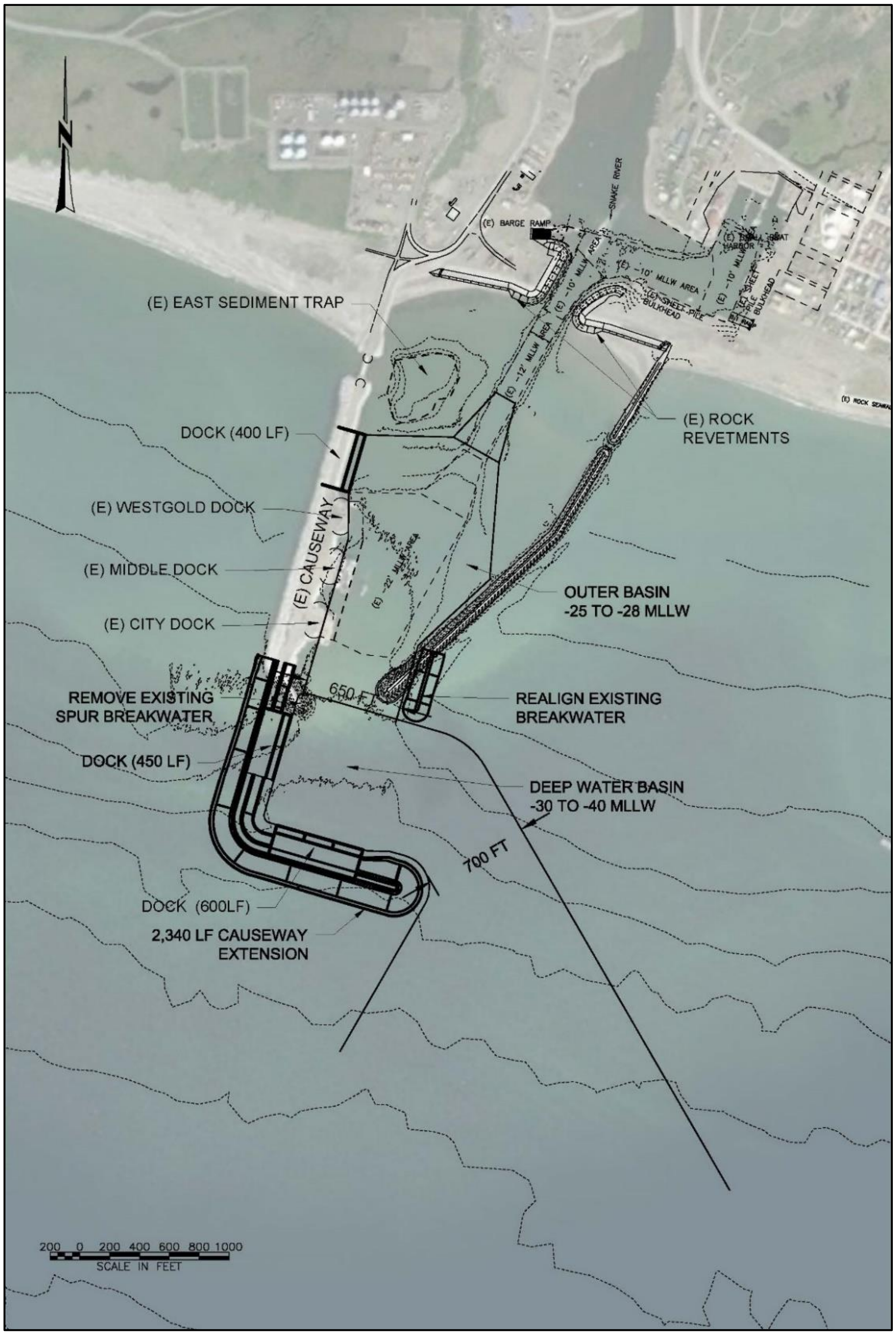

Figure 61. Concept Drawing – Alternative 3a

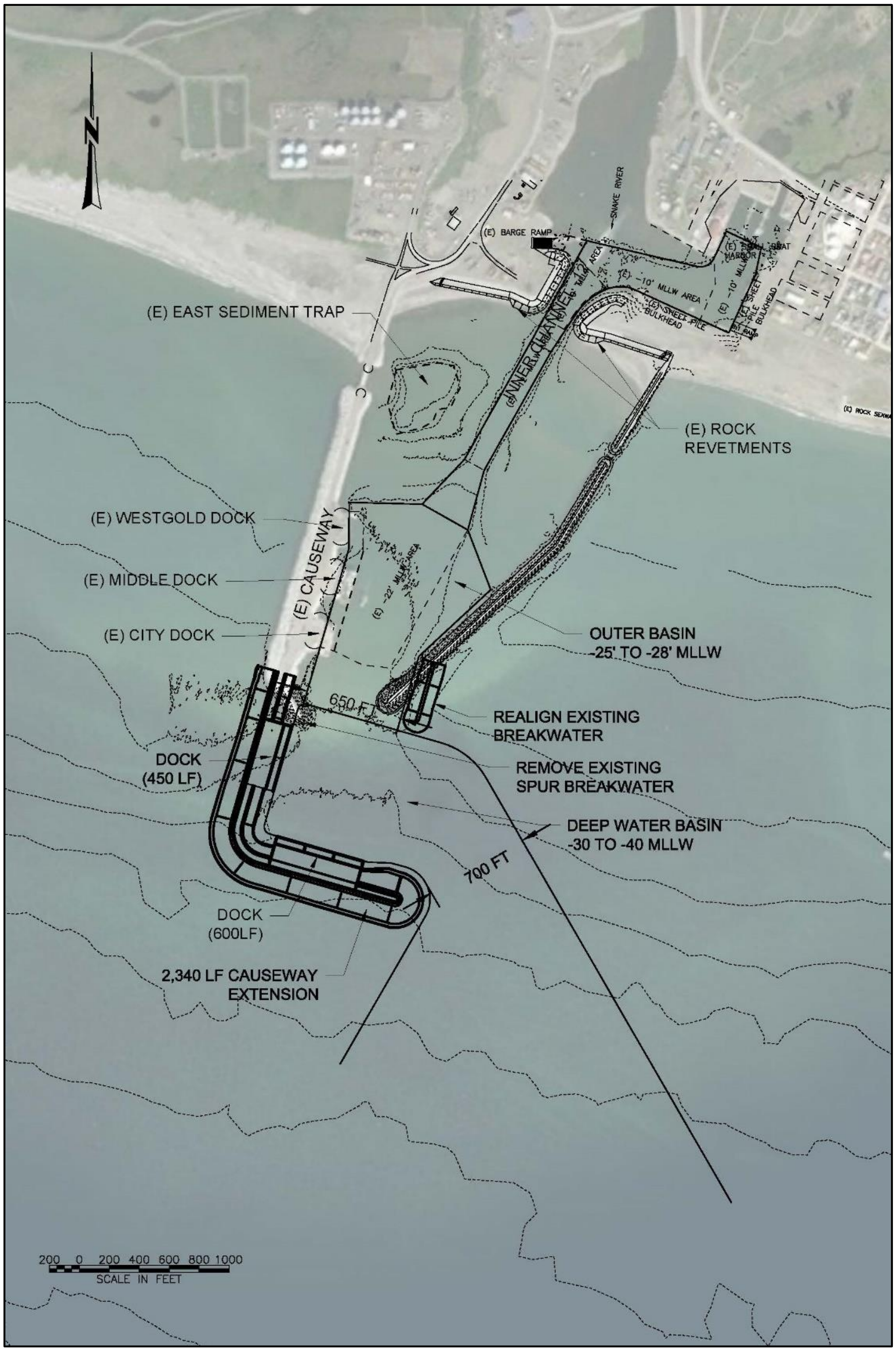

Figure 62. Concept Drawing – Alternative 3b

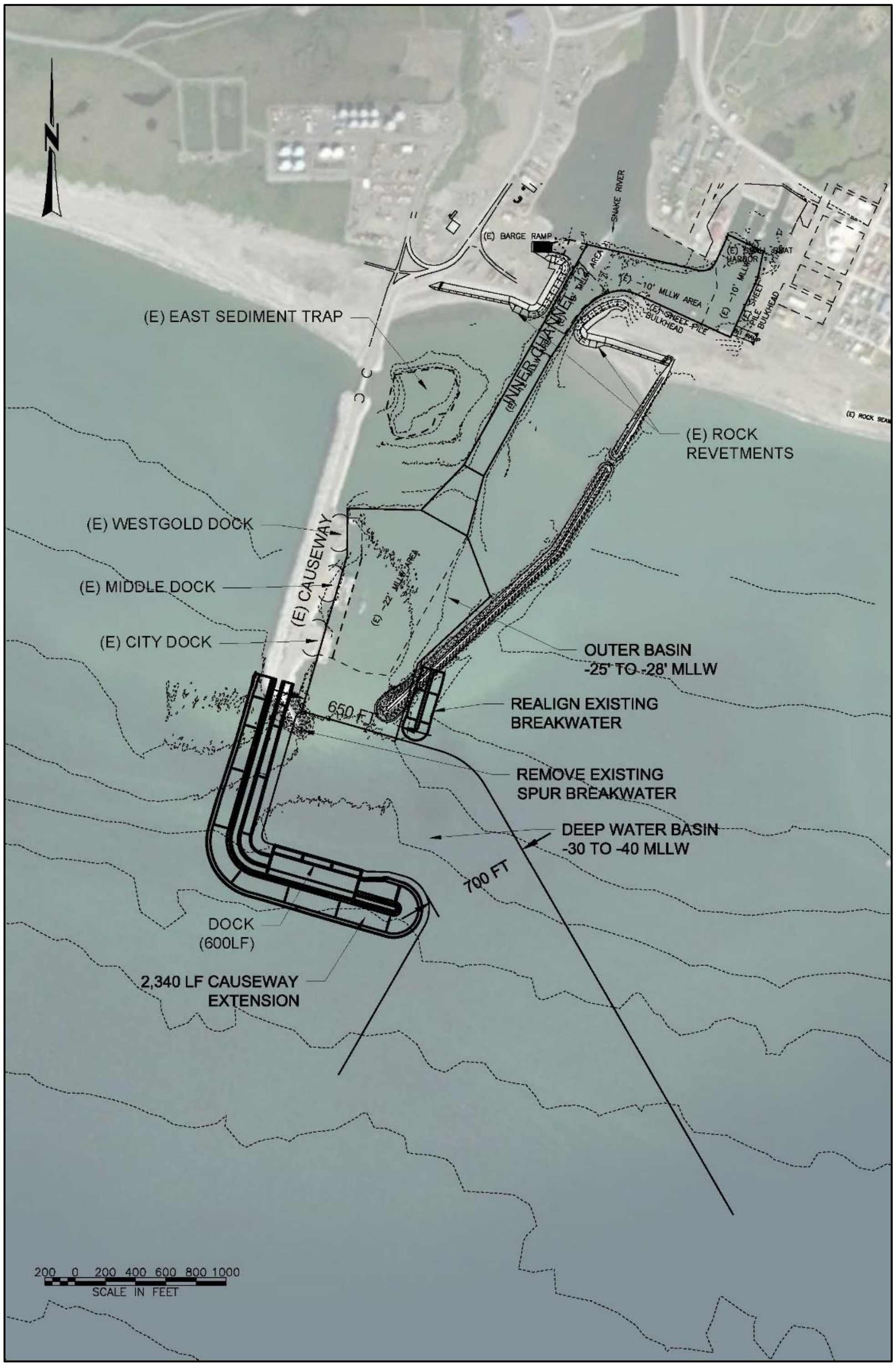

Figure 63. Concept Drawing – Alternative Plan 3c

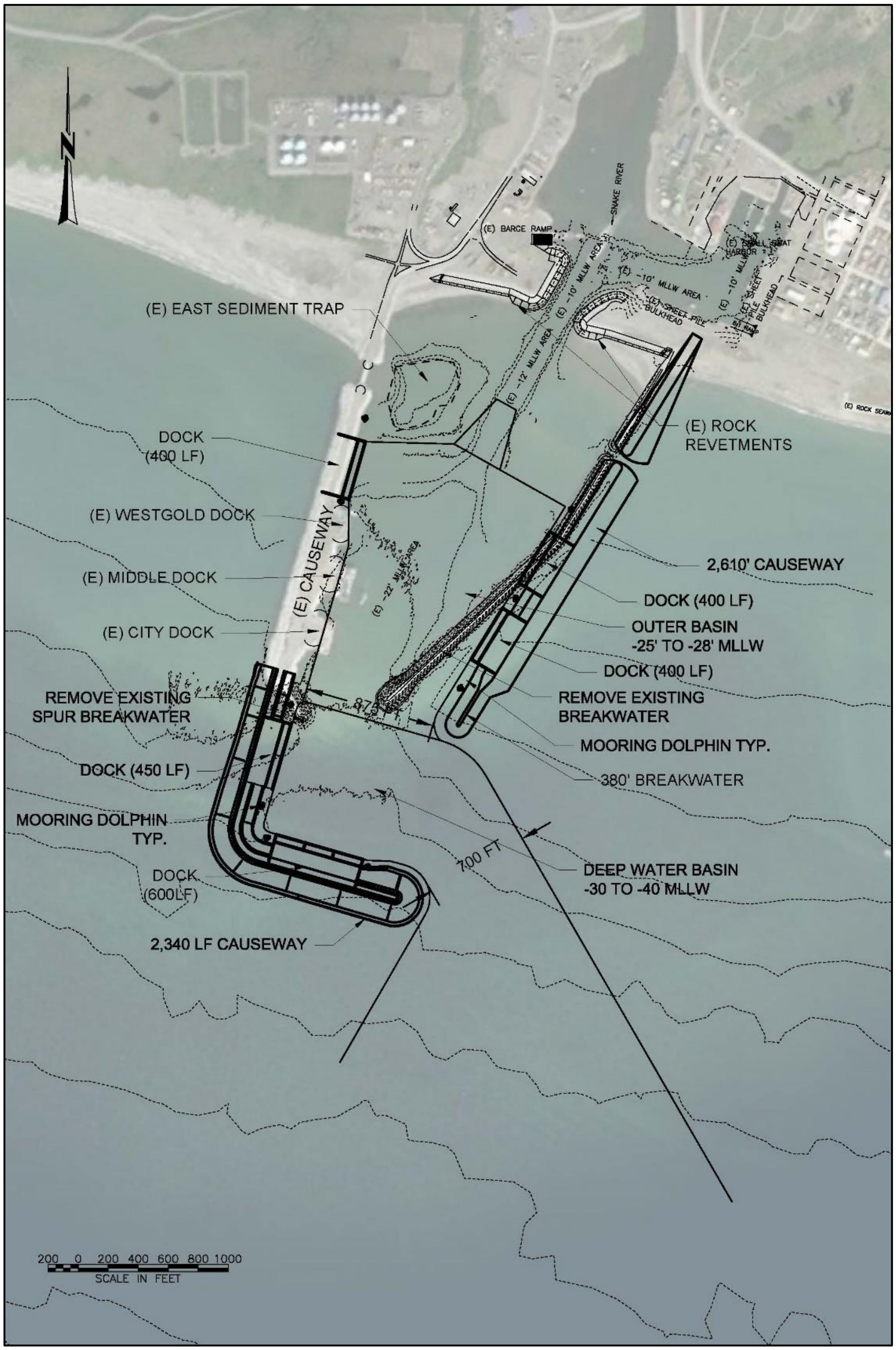

Figure 64. Concept Drawing – Alternative Plan 4a

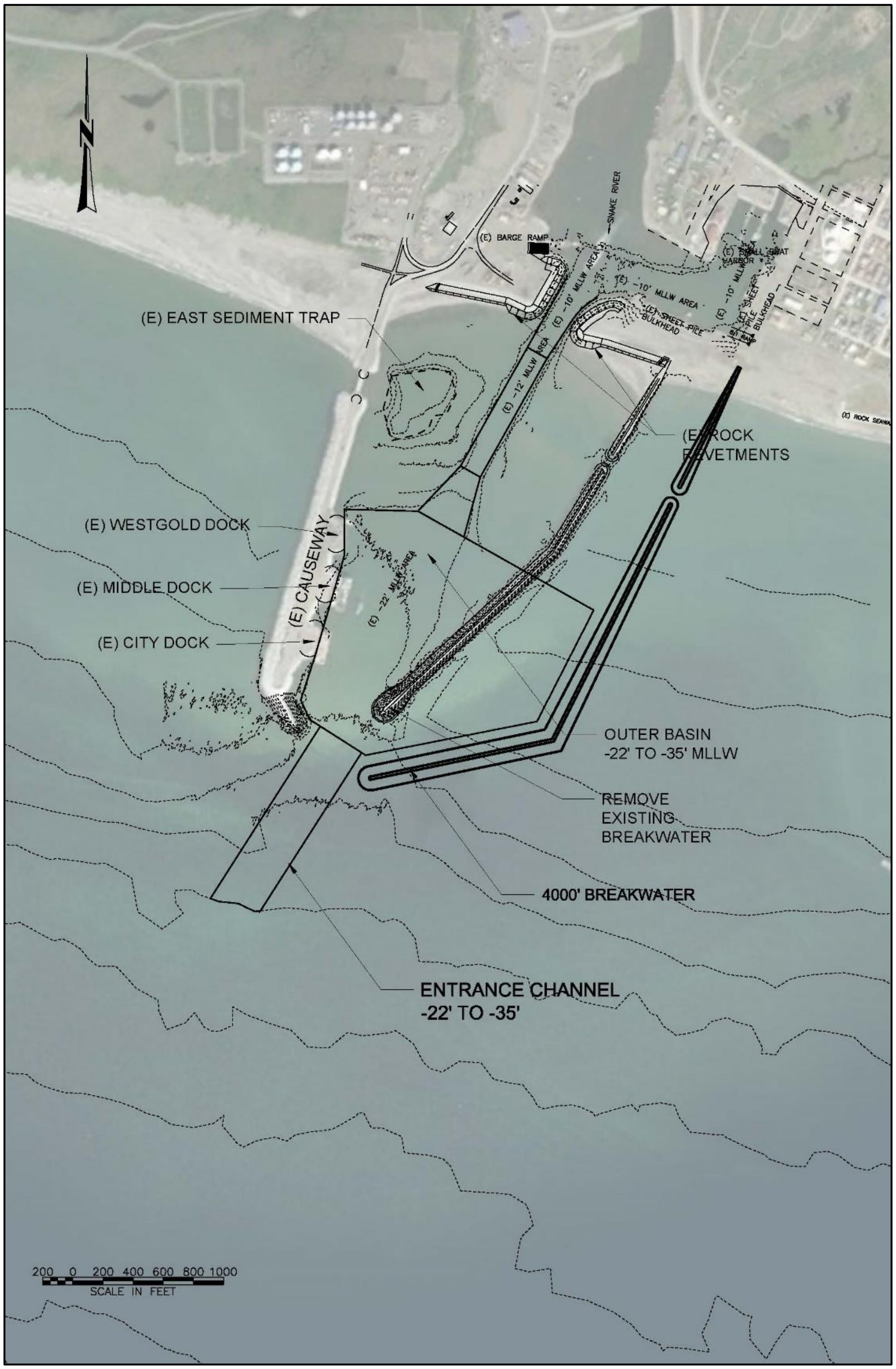

Figure 65. Concept Drawing – Alternative Plan 5

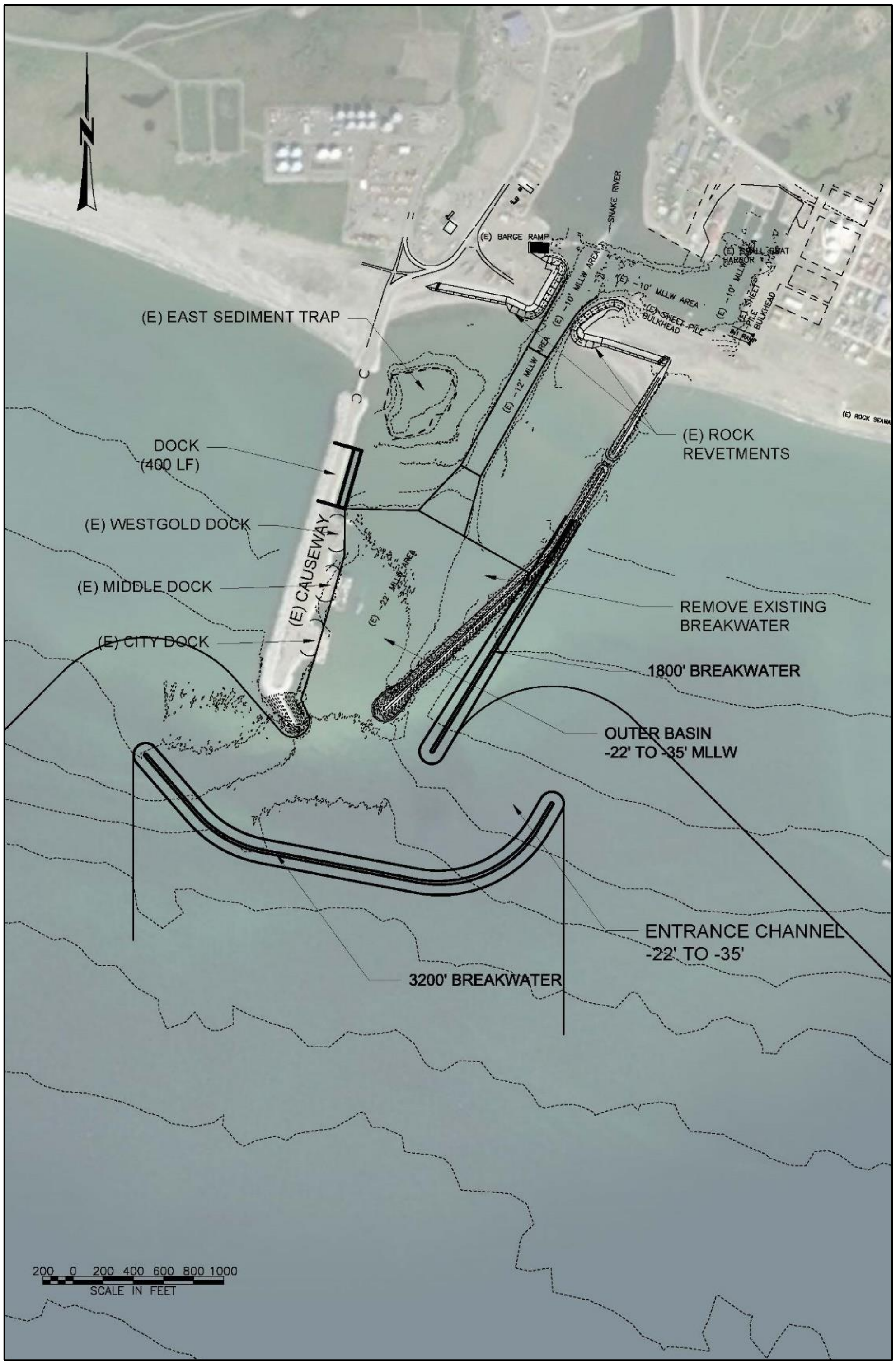

Figure 66. Concept Drawing – Alternative Plan 6

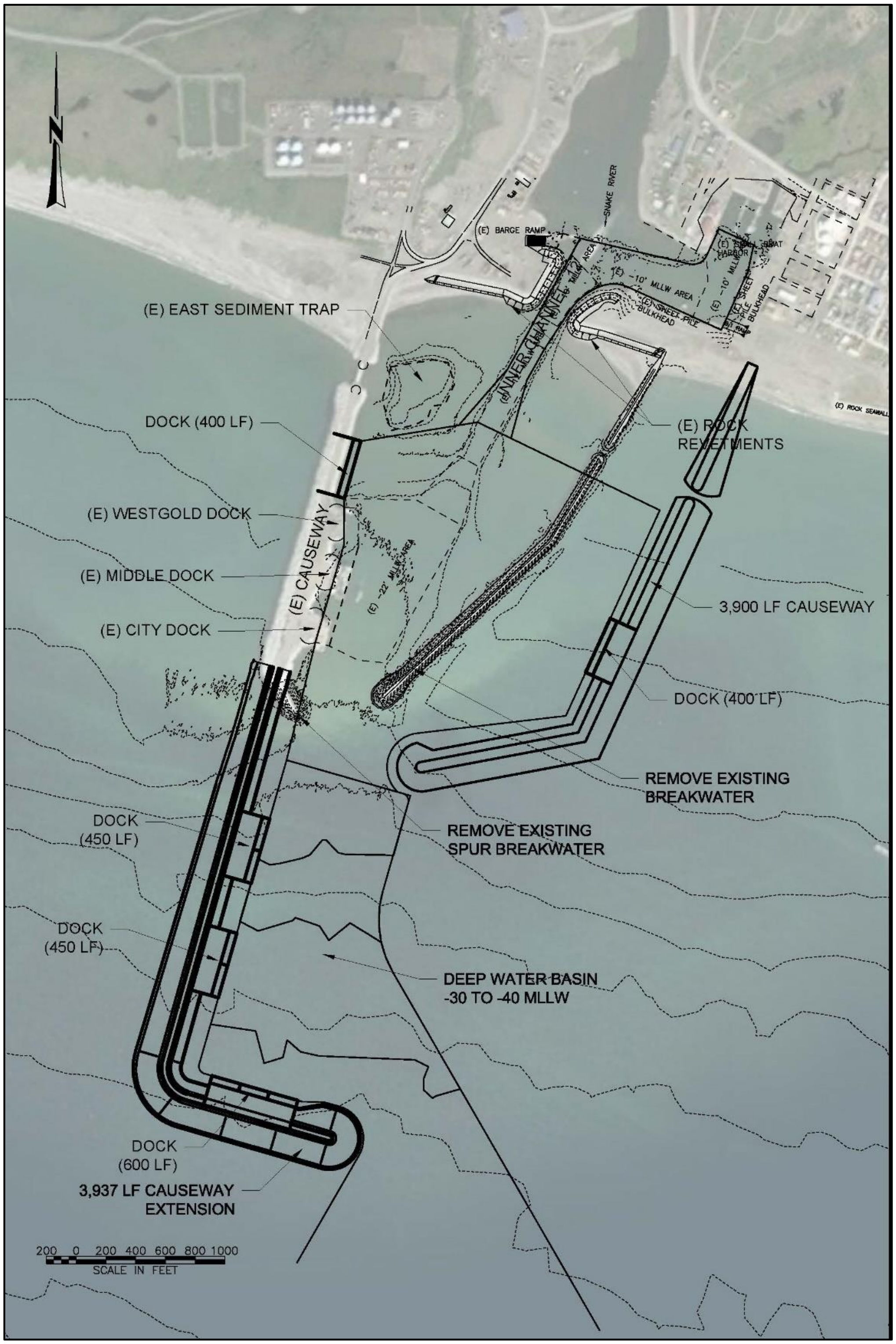

Figure 67. Concept Drawing – Alternative Plan 8a

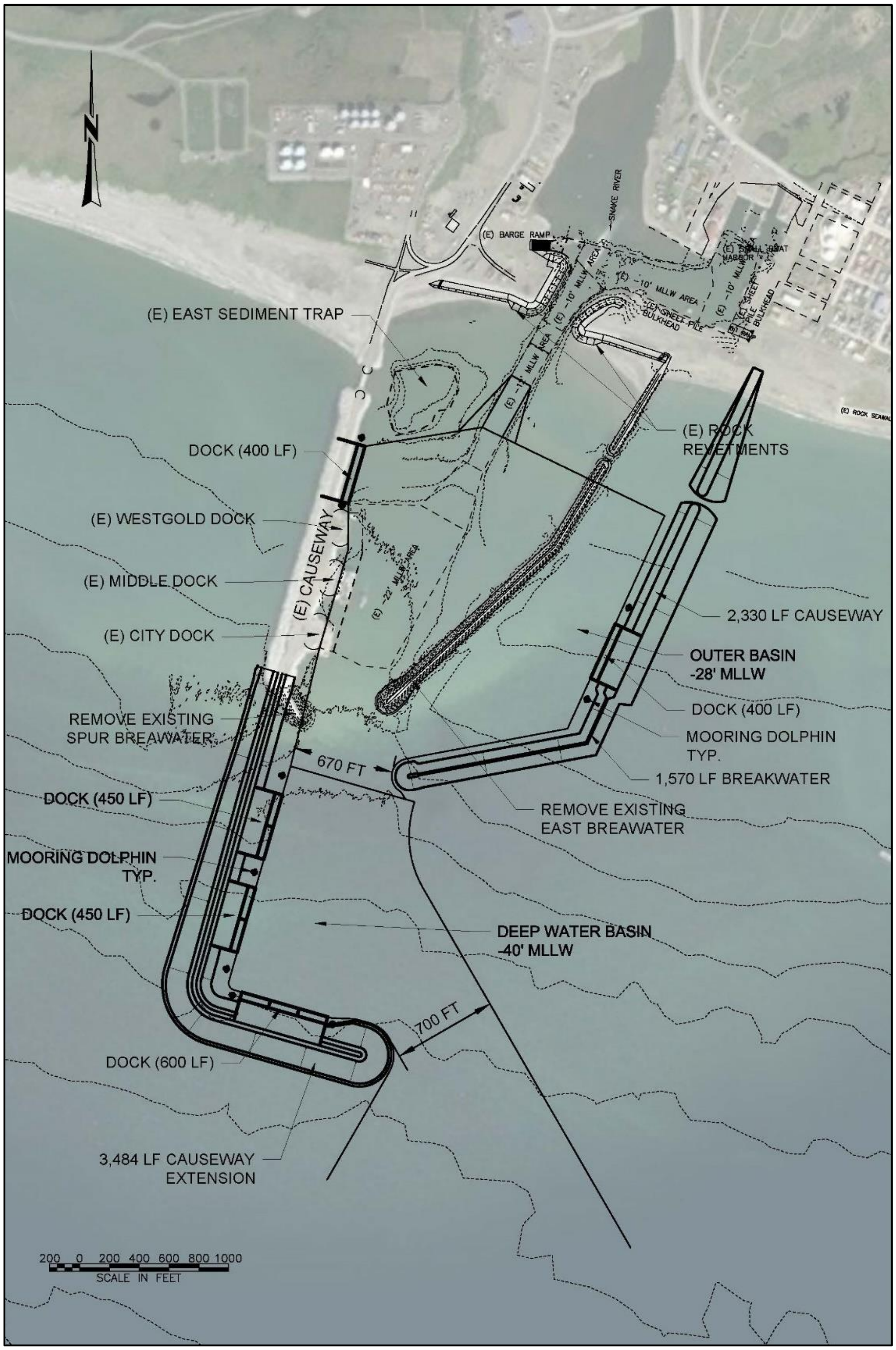

Figure 68. Concept Drawing – Alternative Plan 8b

5.6 Alternatives Carried Forward

Including the no action, seven alternatives were carried forward. The six structural alternatives carried forward contain a combination of measures, including channel deepening, widening, breakwater construction, and berth (dock) additions (Table 21). Some of the alternatives are grouped because they are similar in size and/or configuration with the differentiating measure or measures being the number and/or length of docks added, and/ or length of the causeway. Dredge material management is discussed as a separable element in Section 6.1.

Table 21. Alternatives Carried Forward

Alternative Numbers	General Description of Modification[1] (Includes a reference to Concept Drawings available for each Alternative Plan)
1	No Action
3a, 3b, 3c	2,340 ft long L-Shaped West Causeway extension to approximately -30 ft MLLW and modify East Breakwater (see Figures 61 through 63)
4a	Similar to Alternative 3a-3c, except a portion of the East Breakwater is converted to a combination causeway/breakwater aligned along F Street (see Figure 64)
8a, 8b	3,937 ft (Alt. 8a) or 3,484 ft (Alt. 8b) West Causeway extension to approximately the -45 ft MLLW (Alt 8a) or -40 ft (Alt 8b) bottom elevation, remove East Breakwater, and construct new East Causeway aligned with F-Street) (see Figures 67 and 68).

(1) All the alternatives include additional docks and dredging, except the No Action Alternative.

Each alternative was evaluated for various navigation basin and channel dredge depths. The dredge depth for the Outer Basin is limited by the sheet pile design along the existing causeway to a maximum of -29 ft MLLW; which does include the additional 1-foot of over dredge allowed to the maximum dredge depth line or max pay line. Two dredge depths -25 ft MLLW and -28 ft MLLW were evaluated for the Outer Basin as separable elements. This analysis found the most benefits using the deeper dredge depth as discussed in Chapter 6.0 so a dredge depth of -28 ft MLLW with the max pay line 1 foot deeper than the design depth was used for the Outer Basin in all the alternatives carried forward for evaluation.

For all the alternatives carried forward, the Deep Water Basin was evaluated for dredge depths of -30 ft MLLW, -35 ft MLLW and -40 ft MLLW with the max pay line 2 ft deeper than the design depth so actual dredge depths would be -32 ft MLLW, -37 ft MLLW and -42 ft MLLW depending on the design depth ultimately selected for the recommended plan.

6.0 COMPARISON & SELECTION OF PLANS*

6.1 Dredged Material Management Options – Separable Element

This section is a qualitative evaluation of the dredge methods and management options that are carried forward for each plan. Dredged material management options are initially discussed in Section 5.4.1. Based on the USACE and non-Federal sponsors' experience with previous port dredging operations and the expected sub-seafloor sediment types in the area, two dredging methods were carried forward (mechanical clamshell with scow, and hydraulic suction dredge with pipeline). A mechanical method is typically needed to effectively excavate the dense sediments with cobbles and boulders that are expected to occur in areas and depths that have not been dredged previously. As a result, a mechanical dredge method is proposed for study purposes for new work dredging. A hydraulic method would be used for the annual maintenance dredging because it is typically performed at a lower cost, and is successfully being used for the current maintenance program. This does not mean that the contractor could not, or would not use a combination of methods for new work or maintenance dredging, but for the purposes of the study, all the cost estimates use these two methods with mechanical dredging used for new work and hydraulic dredging used for the maintenance dredge operation.

The placement and/or disposal options are considered given the capabilities of each method to transport the dredged material, as discussed in Section 5.4.1. The three location options carried forward are shown in Figure 69 and are listed below:

- Nearshore placement within the depth of closure estimated to range from -15 ft MLLW to -30ft MLLW
- Off-shore disposal beyond the 3-Mile State/Federal jurisdictional boundary
- Direct shore (beach) placement

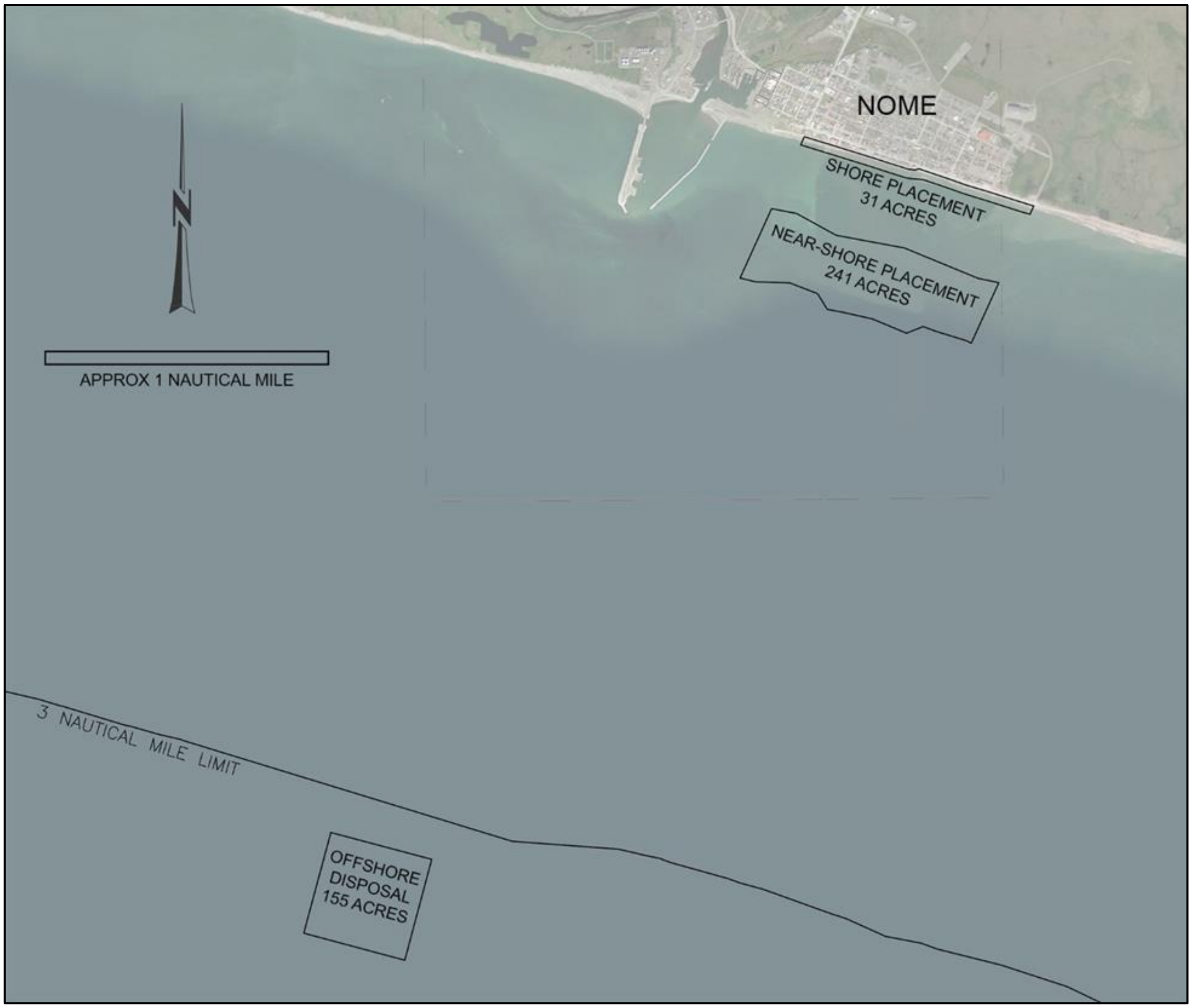

Figure 69. Dredged Material Placement/Disposal Options Carried Forward

The potential cost of transporting material to the dredged material disposal/placement area in each option was a significant factor in selecting an option. Transportation costs correlate to the distance between the area being dredged and the placement area, number of times the material needs to be handled, and plant accessibility. Another factor that was considered, though not part of plan selection, was the potential for beneficial use of the dredged material. The nearshore and direct beach placement options should provide a benefit of building the beach in front of the seawall, although the quantifying that benefit has been difficult to develop because the sea wall has performed for about 50 years or more. The off-shore disposal option has a higher transportation cost than the nearshore placement area, has no potential for a beneficial use, and could impact seafloor habitat.

Of the two placement options, the nearshore placement option was carried forward as the preferred placement option for the new work dredging because it had the lowest cost associated utilization of the placement area and its potential for beneficial use of material (beach nourishment). This was determined to be the low-cost option because it was the closest site to the new work dredge areas, the material was not required to be re-handled once placed on the scow, and the water depth at the placement area allows for fully loaded scows to access the placement area. The direct shore placement option is selected for the maintenance dredging because it is efficient to pump the dredged material to the beach, as is the common practice. The USACE understands that the maintenance dredge equipment may need to be upgraded due to the larger volume of dredged material and potential need to discharge further east than is the current practice.

6.2 Navigation Simulation

Navigation simulation runs were performed for alternatives 3a, 4a, and 8b at the Ship Simulator at the Coastal Hydraulics Laboratory from 2-10 April 2019 by two Alaska Marine Pilots. The results are presented in Appendix C (Hydraulic Design), Section 4. All entrance channels and turning basins meet or exceed the requirements of EM 1110-2-1613 and ER 1110-2-1404. Design assumptions were tested during the navigation simulation study to define operational requirements, and channel and wave protection layout suitability.

The Alaska Marine Pilots LLC submitted a letter dated 27 August 2019, to the District (Appendix G [Correspondence]) expressing their concerns over the utility of alternative 4a due to its inability to accommodate large cruise ships, operations during severe weather condition, adequacy of the entrance channels and turning basins, and unsafe conditions during tanker turns and docking in the Deep Water Basin of alternative 4a (i.e., Use of full stopping power from assist tugs and vessel astern power to stop the vessel). An analysis of the ship simulation log files was conducted to verify the use of maximum tug horsepower and astern vessel power during arrival simulations. Based on the pilot's concern that, use of maximum assist tug power is considered a very unsafe condition, it is recommended that more powerful tugs than those used in the ship simulations (4000 hp) be used in the new harbor.

This pilot's letter expresses safety and maneuverability concerns associated with the smaller dimension plan (specifically Alternative 4a) and the pilot's concerns over the utility of Alternative 4a operations, adequacy of the entrance channels and turning basins, and unsafe conditions during turns and docking. The pilots noted that Alternative 4a does not have adequate maneuvering room and every dock must be vacated of moored vessels when large vessels are accessing the Outer Basin. While the pilots were able to successfully navigate the Outer Basin of 4a with vessels at docks, these runs required precise maneuvers that would not have been attempted with actual vessels due to damage and safety risks. The pilots also noted that a very unsafe condition of full stopping power of assist tug and vessel astern power were required with no margin for error to stop the vessel in the Deep Water Basin of Alternative 4a, and if deceleration operations were initiated too late in the dock approach or stern winds increased, there would be no means to prevent the vessel from colliding with the structure.

The use of maximum assist tug power is considered a very unsafe condition, and the USACE recommended that more powerful tugs than those used in the ship simulations (1700 hp) be used in the new harbor; however, the availability of tugs was not studied during this effort. Both the sponsor and the pilots indicated that it would be difficult to find and sustain tugs larger than the 1700 hp size at Nome due to vessel availability and the expected frequency of use. Pilot comments during the ship simulator suggested tolerable wind speeds for navigation through Alternative 4a would be 10 knots, and wind speeds for 8b would be 20 knots. Based on the airport wind analysis, pilot wind speed requirements to navigate the harbor for 4a would be exceeded 36.3 % of the time during the open water season; whereas, conditions to navigate 8B would be exceeded 2.6 % of the time.

6.3 Four Accounts Overview

USACE planning guidance establishes four accounts to facilitate and display effects of alternative plans:

- National Economic Development Plan
- Regional Economic Development Plan
- Environmental Quality
- Other Social Effects

6.3.1 National Economic Development Plan

In the May 2019 draft IFREA the Tentatively Selected Plan (TSP) was identified on the merits of NED analysis with a positive benefit-cost ratio (BCR). Since May 2019 the NED analysis was updated to determine if an NED Plan was still attainable. As before, the updated NED analysis evaluated benefits against costs associated with improving navigation efficiency. No alternative plan reasonably maximized benefits or resulted in a positive benefit-cost ratio (BCR), indicating that a plan could not be selected on the merits of the NED analysis. Although the BCRs improved considering national security benefits, the BCRs were still below one, no NED plan was identified. The national security benefits originated from NORTHCOM and USCG fuel savings estimates that would result if fuel was obtained at the Port of Nome versus the southern ports such as Dutch Harbor or Kodiak, to name two. Since an NED plan as not identified, the plans were also evaluated using non-monetary benefits through a CE/ICA as discussed in Section 6.5.

6.3.2 Regional Economic Development

Economic benefits that accrue to the region but not necessarily the nation include increased income and employment associated with the construction of a project. Regarding construction spending, further analysis of regional economic benefits is detailed in Appendix D (Economics), Chapter 8.0. The regional economic development (RED) analysis includes the use of regional economic impact models to provide estimates of regional job creation, retention, and other economic measures such as sales or value-added. Each alternative has a positive effect on RED commensurate with its construction expenditure.

In addition to jobs created through construction spending, it is expected that some permanent jobs would be created through the benefits of the proposed project. For instance, increased expenditures on fuel, hunting and fishing, and durable goods could lead to job growth in subsistence, retail, tourism, and other direct and indirect spending areas.

All expenditures associated with construction and operations and maintenance (O&M) work at the Port of Nome were estimated for each alternative. Of this total expenditure, some would be captured within the Nome Census Area. The remainder of the expenditures would be captured within the state impact area and the nation. These direct expenditures generate additional economic activity, often called secondary or multiplier effects. The direct and secondary impacts are measured in output, jobs, labor income, and gross regional product (value-added), as summarized in the following tables. The regional economic effects are shown for the local, state, and national impact areas. Construction effects would occur over the expected duration of the construction period. O&M effects are assumed to occur every year. Total effects are the sum of all construction and O&M effects over the 50-year study period. All jobs effects are calculated and displayed in full-time equivalents (FTE). Based on the regional economic development outputs estimated for each alternative, Alternative 8a provides the most regional economic benefits per category over the period of study (Figure 70).

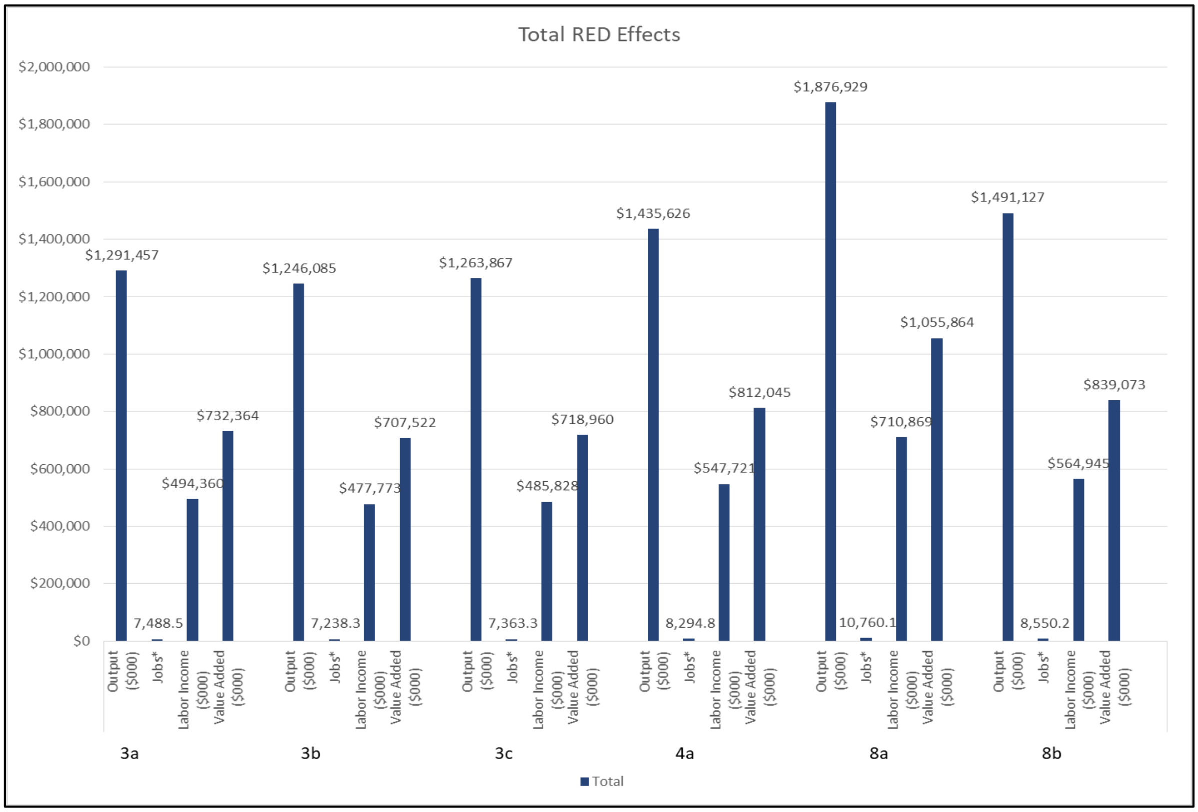

Figure 70. RED Plan Summary

6.3.3 Environmental Quality

Environmental Quality (EQ) displays the non-monetary effects of the alternatives on natural resources and is described more fully in the affected environment (see Chapter 3.0) and environmental consequences (Chapter 8.0) sections of this report. Qualitative enhancements to the environment include a reduction in fossil fuel usage, reduction in fuel spills due to overwater fuel transfer, and emissions due to decreased lightering.

6.3.4 Other Social Effects

The categories of effects in the Other Social Effects (OSE) account include urban and community effects; life, health, and safety factors; displacement; long-term productivity; and energy requirements and energy conservation. The OSE can be either beneficial or adverse (positive/negative) depending on the standard being measured.

Construction of a project supports the local and regional economy and provides income to a small community. This injection of income to the City of Nome allows for the provision of social services to the community, increasing community resilience and quality of life by freeing up resources to support the subsistence lifestyle. Enhanced revenue to local businesses provides incentive to hire additional personnel, providing income stability to more of the local citizenry.

The Section 2006 project authority allowed for consideration of OSE and the other accounts to inform plan selection through the CE/ICA discussed in Section 6.5. This authority is being used to inform the plan selection because the NED analysis did not identify an NED plan.

6.4 NED Analysis

Each structural alternative was evaluated for various navigation channel dredge depths for the Outer and Deep Water Basins, which the PDT consider separable elements, ER 1105-2-100 states that "a separable element is any part of a project which has separately assigned benefits and costs, and which can be implemented as a separate action (at a later date or as a separate project)" (Appendix D [Economics], Section 6.2). As separable elements may need to be incrementally justified in some cases, benefits and costs for each of them will be analyzed for each alternative, as seen in Table 22:

Each of the six structural project alternatives carried forward, alternative 3a-3c, 4a, 8a and 8b, (see Table 21) contain differences in the second element, the changes in the Deep Water Basin and additional docks. In each of those alternatives, the Outer Basin was assumed to have been deepened from -22 ft to -28 ft MLLW. However, to ensure this element was analyzed per USACE guidance, benefits and costs were also calculated for deepening the existing Outer Basin to -25 ft (-26 ft MLLW max pay) and -28 ft max pay (-27 ft MLLW with 1-ft over dredge allowance) along with the results presented in the first two rows in Table 23. As stated in Appendix D (Economics), Section 6.2, in order for tankers to benefit from deepening the Outer Basin, they would need to be small enough to call at around 21 to 24 ft. If it is assumed that the tanker called once a year, it would be able to load more with a deeper harbor. That would eliminate fuel barge trips needed to lighter fuel into the port. Therefore, every fully loaded small tanker could eliminate one lightering barge call in the -25 ft alternative, and two lightering barge calls in the -28 ft alternative. It is estimated that the -25 ft alternative would produce $15,000 in annual benefits, and the -28 ft alternative would produce $30,000 in annual benefits by eliminating two lightering calls. The maximum dredge depth for the Outer Basin was limited by the sheet pile dock design along the existing causeway to -29 ft MLLW. All the plans create a Deep Water Basin varying in surface area, with dredge depths evaluated at three depths, -30 ft, -35 ft, and -40 ft MLLW (Table 22). Costs and benefits are listed at FY20 price levels and using the FY20 discount rate of 2.75 %.

The six structural alternatives carried forward contain a combination of measures, including:

- causeway and breakwater construction for Deep Water Basin,
- widening the Outer Basin entrance channel,
- channel deepening in the Outer and Deep Water Basins,
- berth/dock additions.

A summary of the NED analysis results is presented in Table 23. Of the six structural plans, Alternative 3a through Alternative 3c are the smaller plans (see Figure 61 through Figure 63) in that the Outer Basin modifications are minimal, and the total project costs are less than the other alternatives (Table 23). Alternative 4 represents a major modification of the Outer Basin in that the east breakwater is converted into a causeway, and the total project cost lies between the other alternatives evaluated. Alternatives 8a and 8b are similar in relative size and have the highest total project costs (Table 23). Alternative 8a extends the west causeway to the deepest water (-45 ft MLLW), versus approximately -40 ft MLLW, which creates a larger Deep Water Basin with the potential to reduce the new work dredging cost to accommodate deep-draft vessels.

Proposed navigation improvements at Nome may also support National Security needs in the Arctic. The Nome project also has the opportunity to include consideration of benefits to National Security. Section 1202(c)(3) of WRDA 2016 expands the feasibility justification of an Arctic deep draft harbor and related navigation improvements to include consideration of benefits associated with National Security and homeland protection. Corps implementation guidance for this legislation states that the identification of a recommended plan can be supported by a CE/ICA. The Corps provided additional guidance on consideration of National Security benefits in a July 2018 memorandum from a meeting of the NWD/POD Regional Integration Team.

Table 22. Alternative Plans with Detailed Measures

<table>
<tr><th colspan="2" rowspan="4">Alternative No. and Description</th><th colspan="11">Measures Summary</th></tr>
<tr><th colspan="8">Existing Outer Basin</th><th colspan="3">New Deep Water Basin</th></tr>
<tr><th colspan="2">West Causeway Modifications</th><th colspan="4">East Breakwater Modifications</th><th colspan="2">Dredge Depths (ft MLLW)(1)</th><th rowspan="2">Causeway Extension (LF)</th><th rowspan="2">New Docks(2)</th><th rowspan="2">Basin Dredge Depths Evaluated (ft MLLW)(1)</th></tr>
<tr><th>Remove Spur (yes/no)</th><th>New Docks(2)</th><th>Entrance Width (LF)</th><th>Causeway/ Breakwater (LF)</th><th>Relocation Aligned with F Street</th><th>New Docks(2)</th><th>Basin Depths Evaluated</th><th>Transition Channel to Inner Harbor</th></tr>
<tr><td>1</td><td>FWOP/No Action</td><td>N/A</td><td>N/A</td><td>N/A</td><td>N/A</td><td>N/A</td><td>N/A</td><td></td><td>N/A</td><td>N/A</td><td>N/A</td><td>N/A</td></tr>
<tr><td colspan="13">Alternative 3 with Options 3a, 3b, & 3c (2340 ft long L-Shaped West Causeway extension and modify East Breakwater)</td></tr>
<tr><td>3a</td><td>Two New Deep Water Docks /
One New Outer Harbor Dock</td><td rowspan="3">yes</td><td>(1) 400 ft</td><td rowspan="3">650</td><td>0 / 450</td><td rowspan="3">no</td><td rowspan="3">no</td><td rowspan="3">-25 & -28</td><td rowspan="3">-12</td><td rowspan="3">2,340</td><td>(1) 450 ft
(1) 600 ft</td><td rowspan="3">-30
-35
-40</td></tr>
<tr><td>3b</td><td>Two New Deep Water Docks</td><td>no</td><td>0 / 450</td><td>(1) 400 ft
(1) 600 ft</td></tr>
<tr><td>3c</td><td>One New Deep Water Dock</td><td>no</td><td>N/C</td><td>(1) 600 ft</td></tr>
<tr><td colspan="13">Alternative 4 (2340 ft long L-Shaped West Causeway Extension and new East Causeway/breakwater)</td></tr>
<tr><td>4</td><td>Two New Deep Water Docks /
Three New Outer Harbor Docks</td><td>yes</td><td>(1) 400 ft</td><td>875</td><td>2,610 / 380</td><td>no</td><td>(2) 400 ft</td><td>-25 & -28</td><td>-12</td><td>2,340</td><td>(1) 450 ft
(1) 600 ft</td><td>-30
-35
-40</td></tr>
<tr><td colspan="13">Alternative 8 West Causeway extension, remove East Breakwater, and construct new East Causeway/Breakwater combination)</td></tr>
<tr><td>8a</td><td rowspan="2">West Causeway Extension and relocate East Breakwater</td><td rowspan="2">yes</td><td rowspan="2">(1) 400 ft</td><td rowspan="2">670</td><td rowspan="2">2,300 / 1,570</td><td rowspan="2">yes</td><td rowspan="2">(1) 400 ft</td><td rowspan="2">-25 & -28</td><td rowspan="2">-12</td><td>3,937</td><td rowspan="2">(2) 450 ft
(1) 650 ft</td><td rowspan="2">-30
-35
-40</td></tr>
<tr><td>8b</td><td>3,484</td></tr>
</table>

1) - All dredge depths are in feet to a Mean Lower Low Water (MLLW) vertical datum.
2) - (1) 400 ft indicates one new dock with an approximate length of 400 feet.
N/C = no change to the navigation feature
N/A = not applicable
LF = Linear feet

Table 23. NED Analysis Summary – Alternative Plans Carried Forward ($1,000s) FY20 price levels and discount rate (2.75 %)

Alternative	Total Investment	AAEQ Benefits	Incr. AAEQ Benefits	Total AAEQ Costs	Incr. AAEQ Costs	Net Benefits	BCR	Net and Nat'l Security Benefits	BCR NED and Nat'l Sec.
Outer Basin 25	$9,654	$77	-	$1,597	-	($1,520)	0.0	($1,520)	0.0
Outer Basin 28	$11,495	($103)	-	$1,666	$69	($1,769)	-	$2,709	2.6
3a Deep Water Basin									
30 ft	$296,567	$1,381	-	$12,514	-	($11,126)	0.1	($6,570)	0.5
35 ft	$306,145	$1,447	$66	$16,145	$3,632	($14,698)	0.1	($8,459)	0.5
40 ft	$330,390	$2,203	$756	$14,629	$2,115	($12,246)	0.2	($1,756)	0.9
3b Deep Water Basin									
30 ft	$281,540	$172	-	$12,185	-	($12,013)	0.0	($7,457)	0.4
35 ft	$299,775	$244	$72	$15,874	$3,689	($15,630)	0.0	($9,391)	0.4
40 ft	$315,925	$1,000	$756	$14,321	$2,136	($13,321)	0.1	($2,651)	0.8
3c Deep Water Basin									
30 ft	$267,923	$172	-	$11,861	-	($11,510)	0.0	($6,953)	0.4
35 ft	$281,892	$244	$472	$15,761	$3,900	($15,517)	0.0	($9,728)	0.4
40 ft	$302,219	$1,000	$756	$13,813	$1,952	($12,813)	0.1	($2,143)	0.8
4a Deep Water Basin									
30 ft	$361,408	$1,270	-	$15,633	-	($14,368)	0.1	($9,807)	0.4
35 ft	$386,712	$1,315	$45	$19,019	$3,386	($17,704)	0.1	($11,465)	0.4
40 ft	$394,531	$2,068	$753	$17,722	$2,089	($15,654)	0.1	($4,984)	0.7
8a Deep Water Basin									
30 ft	$652,754	$1,270	-	$27,190	-	($25,920)	0.0	($21,364)	0.2
35 ft	$648,279	$1,315	$45	$28,708	$1,518	($27,393)	0.0	($21,154)	0.3
40 ft	$680,283	$2,068	$753	$28,637	$1,447	($26,569)	0.1	($15,899)	0.4
8b Deep Water Basin									
30 ft	$622,303	$1,270	-	$25,852	-	($24,582)	0.0	($20,026)	0.2
35 ft	$617,559	$1,315	$45	$26,706	$854	($25,391)	0.0	($19,152)	0.3
40 ft	$635,525	$2,068	$753	$27,300	$1,448	($25,232)	0.1	($14,652)	0.5

Notes: AAEQ = Average Annual

The NED analysis (without national security benefits included) indicates that no positive net benefits exist for any plan. Even if national security benefits are considered, there is still no NED plan.

6.5 Cost Effectiveness and Incremental Cost Analysis

In addition to contributions to NED, a Federal project at Nome may be justified with regional benefits as outlined in Section 2006 of WRDA 2007 as amended. This allows for the consideration of benefits to communities located within the Nome region when evaluating navigation improvements for Nome's harbor. This provision allows the approval for such harbors without the need to demonstrate justification solely on NED benefits if the long-term viability of a community located within the region served by the project would be threatened without the navigation improvements.

For this study, Section 2006 provides an opportunity to consider the additional benefits in the RED, OSE, and EQ accounts through a CE/ICA. These were developed so that there was no double-counting of benefits between the four accounts. USACE implementation guidance for this legislation calls for an assessment of project benefits, including:

- Public health and safety of the local community, including access to facilities designed to protect public health and safety;
- Access to natural resources for subsistence purposes;
- Local and regional economic opportunities;
- Welfare of the local population; and
- Social and cultural value to the community.

This authorization follows recent research and literature on a need for an expanded U.S. presence in the Arctic. The most recent Arctic Strategy from the Department of Defense (2016) highlights the need for an improved Arctic presence. The need for an Arctic deep draft port is identified specifically in the infrastructure needs assessment published by the U.S. Committee on the Marine Transportation System Arctic Marine Transportation Integrated Action Team (2016).

National Security contributions of alternative plans were evaluated in terms of National Security Units (NSUs). The framework could support evaluation of NSUs by themselves, as well as in combination with the community viability unit (CVU) discussed above. For the purpose of the main alternatives evaluation, NSUs are considered separately from CVUs.

Sections 2006 benefit categories were identified that represent issues of importance to the Nation, to project stakeholders in Nome, and to the region served by the port. To characterize the long-term community viability at Nome and other communities served in the region by the port, (collectively referred to simply as community viability from herein); the PDT identified a set of variables that were perceived to impact community viability, and During subsequent iterations of formulation, sensitivity analysis, and through the model approval process, the PDT refined and simplified this flowchart to include only those variables which provided useful information for the plan formulation and evaluation process after various meetings settled on the four variables listed below:

- Other Port Economic Effects (OPE)
- Port of Refuge Effects (PRE)
- Cargo Delivery Reliability (CDR)
- Overwater Fuel Transfer (OFT)

The CE/ICA evaluation framework has been approved for one-time use in accordance with EC 1105-2-412, Assuring Quality of Planning Models with the approval documented in a Memorandum for Record (USACE 2019c; see Appendix D, Attachment 2). The variables above were ranked as they related to each alternative plan with a qualitative scoring system, and then the scores were combined for each alternative to create a community viability unit (CVU) score for each alternative. Section 1202 benefit categories were identified that variables were developed to capture national security differences in expected outputs among alternatives. These National Security Units, or NSUs, were maintained as a separate element from the CVUs for community viability. The collection of variables and their relationships is graphically depicted in Figure 71. A summary description and benefit to each variable is described further in Table 24. The benefit discussion in Table 24 links the variable to the study objectives and the considerations of Section 2006.

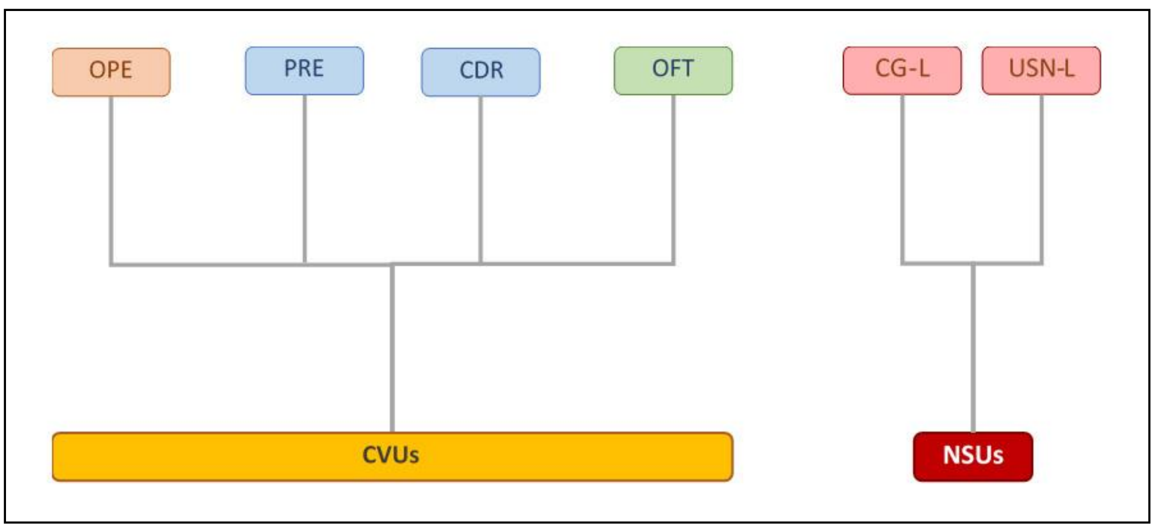

Figure 71. CE/ICA Framework / Community Viability Units and National Security Units

Table 24. CVU Summary

CVU Variables	Summary Description of CVU Variable and Benefit
Other Port Economic Effects (OPE)	Expected permanent growth in local economic opportunities at the port and related local businesses from increased business at the port. OPE variable considers community welfare and regional economic opportunities, which are critical to the viability of rural and subsistence communities in the Arctic.
Port of Refuge Effects (PRE)	Addresses the safety of vessels and crews in inclement weather. PRE variable considers how each alternative could potentially improve refuge opportunity by both reducing existing wave climate inside the harbor and expanding the port's refuge capacity in the development of scores.
Cargo Delivery Reliability (CDR)	Addresses the reliable delivery of essential goods to regional communities, which directly affects the long-term viability of remote and subsistence communities and is dependent upon affordable, reliable, and timely cargo transshipment and barge delivery services provided by Nome. The reliable delivery of essential goods to regional communities is significant to the health and welfare of the local population, as well as being a factor in residents' participation in subsistence activities and the ability to maintain the region's unique cultural heritage.
Overwater Fuel Transfer (OFT)	Variable to represent environmental quality (EQ) benefits with the region's subsistence culture dependent on accessible, high-quality natural resources. OFT considers the reduction in overwater fueling afforded by each alternative. An increase in dock space and depth for refueling vessels could reduce the need for overwater fuel transfers, reducing the opportunity for environmental contamination.
NSU Variables	**Summary Description of NSU Variable and Benefit**
Coast Guard Logistics (CG-L)	Representative of likely benefits to National Security consistent with Section 1202(c)(3) and related implementation guidance. Whether the alternative would support refueling of cutters and icebreakers at the Port, identification of relative output among the alternatives considers both the support for cutter refueling and icebreaker refueling, as the icebreakers have a deeper draft. Sufficient depth for the vessels to enter the harbor would also facilitate more efficient supply and crew changes.
U.S. Navy Logistics (USN-L)	In addition to providing fuel for forces operating in the northern Bering, southern Chukchi, and western Beaufort Seas, an accessible port would provide unique benefits to Homeland Defense, including a port of refuge, logistics support, and a location to loiter as the maritime situation unfolds.

More variables than those presented in the table above were considered by the PDT, and some were initially ranked during the study; however, they were dropped from the analysis because the variable was found not applicable to community viability, or the score was the same for each alternative, so it had no impact on the ranking of the alternatives (non-differentiating score).

Scoring of outputs on a scale of 1 to 10 (10 being the highest) for each combination of alternative and variable scenario was performed by the PDT in order to facilitate group discussion and consensus. Variables with a higher score were thought to support community viability better within that plan. The scores were reviewed and judged by the PDT to be representative of changes in conditions from the FWOP condition for each variable with each alternative and dredge depth considered. A sensitivity analysis was performed, which confirmed that equal weighting of these variables was appropriate, so the average score multiplied by a factor of 100 is considered the CVU for an alternative (Table 25). A more detailed explanation of the CVU and NSU variables and the methodology used to develop the scoring is presented in Appendix D (Economics), Chapter 9 Additional Benefits Analysis.

Table 25. Variable Scores and CVU Total

Alternative	Depth	CVU Variable Scores					NSU Variable Scores				
							CG-L		USN-L		
		OPE	PRE	CDR	OFT	CVU Total Score	Ice-breaker	Cutter	Comb.	Aux.	NSU Total Score
No Action	**-**	0	0	0	0	0	0	0	0	0	
Alt 3a	**30 feet**	4	1	3	3	275					
	35 feet	6	2	4	4	400					
	40 feet	7	3	5	5	500					
Alt 3b	**30 feet**	3	1	2	2	200					
	35 feet	4	2	3	3	300					
	40 feet	5	3	4	4	400					
Alt 3c	**30 feet**	2	1	1	2	150					
	35 feet	3	2	2	2	225					
	40 feet	4	3	3	3	325					
Alt 4a	**30 feet**	6	6	5	6	575	0	8	0	0	200
	35 feet	8	7	6	8	725	0	9	0	0	200
	40 feet	10	8	7	10	875	8	10	8	8	900
Alt 8a	**30 feet**	6	8	8	6	700	0	8	0	0	200
	35 feet	8	9	9	8	850	0	9	0	0	200
	40 feet	10	10	10	10	1000	10	10	10	10	1000
Alt 8b	**30 feet**	6	7	7	6	650	0	8	0	0	200
	35 feet	8	8	8	8	800	0	9	0	0	200
	40 feet	10	9	9	10	950	10	10	10	10	1000

Notes: (1) Dredge depths only include the Deeper Water Basin. CG-L = U.S. Coast Guard Logistics; USN-L U.S. Navy Logistics

Alternatives 4, 8a, and 8b resulted in the highest total CVUs for each dredge depth considered with Alternative 8a having the highest CVU total for each dredge depth (Figure 72).

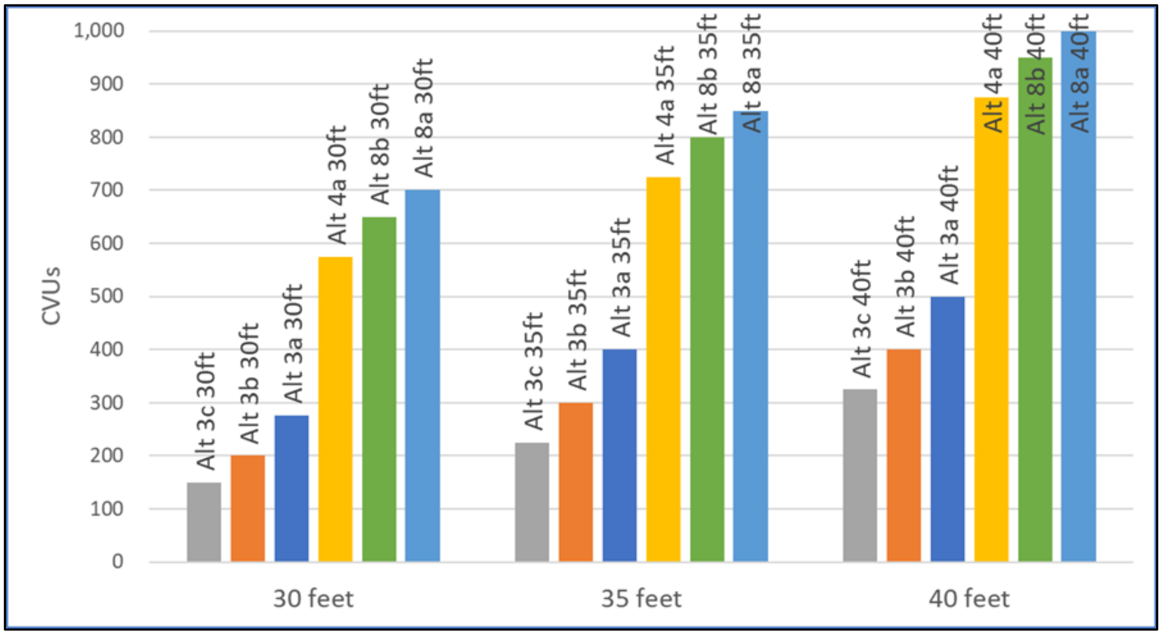

Figure 72. Community viability units for the range of alternatives without NSUs

NSU scoring performed on Alternatives 4, 8a, and 8b is shown in Figure 73.

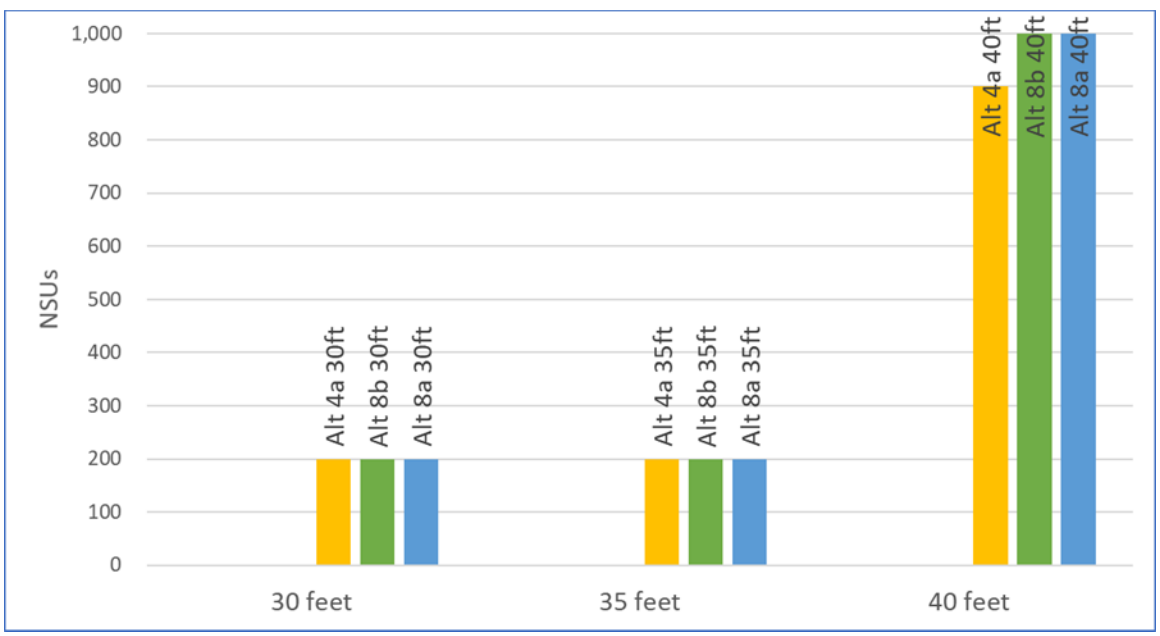

Figure 73. NSUs by Alternative

The CE/ICA model run, using the IWR Planning Suite, relied on project costs developed by USACE. The modeling details are presented in Appendix D (Economics), Section 9.2. The model ranks each alternative according to their cost-effectiveness and incremental cost. Of the total possible 19 plans (6 alternatives with 3 depth options), including the No Action, there were eight plans which were not cost-effective, eight which were cost-effective but not best buys, and three which were best buys. Best buy plans over the No Action, in order of total output, were Alternatives 4a (40ft) and 8a (40ft) (Table 26).

Table 26. CE/ICA Model Results – without NSUs

Plan	Annualized Cost $1000	Output	Cost/Output $1000	Type
No Action	**$0**	**0**	**-**	**Best Buy**
3c - 30ft	$11,681	150	$46	Cost Effective
3b - 30ft	$12,185	200	$40	Cost Effective
3c - 35ft	$15,761	225	$29	Non-Cost Effective
3a - 30ft	$12,514	275	$61	Cost Effective
3b - 35ft	$15,874	300	$53	Non-Cost Effective
3c - 40ft	$13,813	325	$36	Cost Effective
3b - 40ft	$14,321	400	$78	Cost Effective
3a - 35ft	$16,145	400	$70	Non-Cost Effective
3a - 40ft	$14,629	500	$43	Cost Effective
4a - 30ft	$15,633	575	$27	Cost Effective
8b - 30ft	$25,852	650	$26	Non-Cost Effective
8a - 30ft	$27,190	700	$20	Non-Cost Effective
4a - 35ft	$19,019	725	$39	Non-Cost Effective
8b - 35ft	$26,706	800	$34	Non-Cost Effective
8a - 35ft	$28,708	850	$27	Non-Cost Effective
4a - 40ft	$17,722	875	$40	**Best Buy**
8b - 40ft	$27,300	950	$33	Cost Effective
8a - 40ft	$28,637	1000	$29	**Best Buy**

Alternatives 4a and 8a are identified as best buy plans and Alternative 8b as a cost-effective plan in the output versus costs without considering the NSU variable (Figure 74).

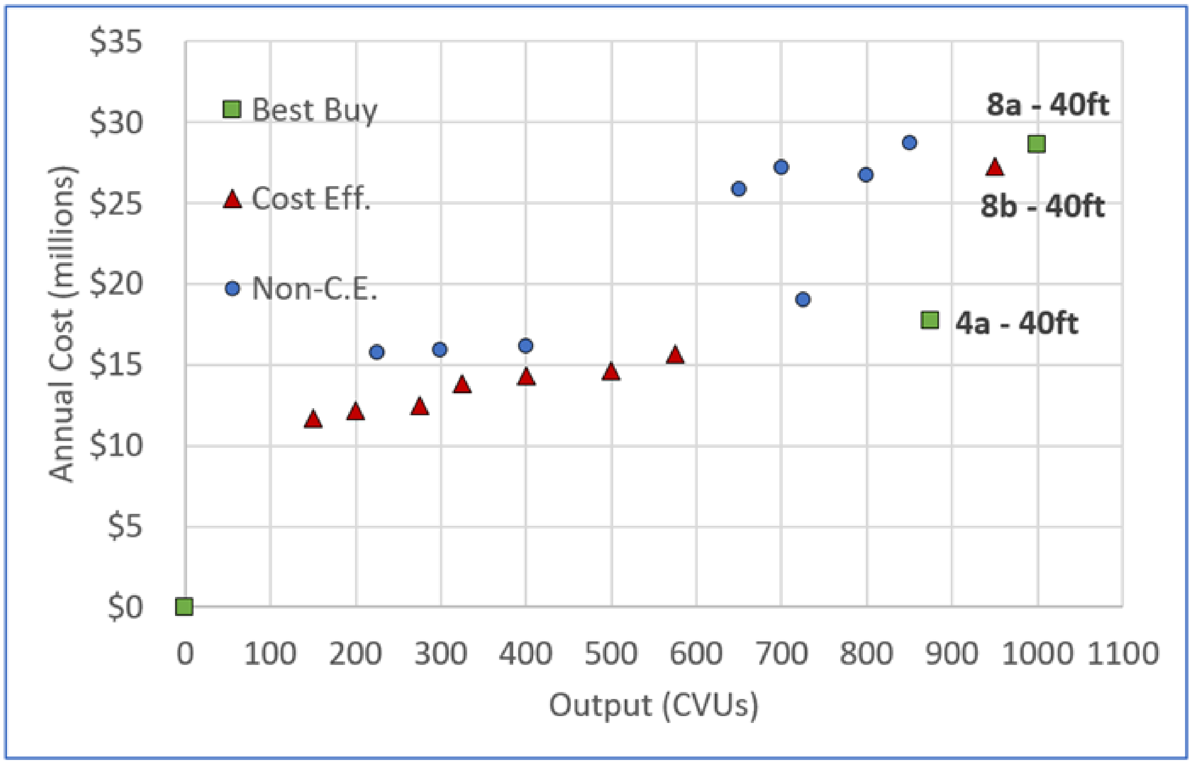

Figure 74. All Possible Plans, CVUs without NSUs

The incremental cost calculation results show what the incremental cost is to “buy up” to the next plan to capture the additional CVUs (Table 27).

Table 27. Incremental Cost Summary for Best Buy Plans without NSUs

Best Buy	Alternative	Annualized Cost $1000	Incremental Cost $1000	CVU Total Output	Incremental Output	Incremental Cost/Output $1000(1)
1	No Action	$0	$0	0	0	$0
2	Alt 4, 40ft	$17,722	$17,722	875	875	$20
4	Alt 8a, 40ft	$28.637	$10,915	1000	125	$87

Notes: (1) Alt 4, 40 ft incremental cost calculation ($17,722 / 875 = $25)
Alt 8a, 40 ft incremental cost calculation ($28,637-$17,722) / (100-875) = $87

The incremental cost box plot for the best buy plans is presented in Figure 75.

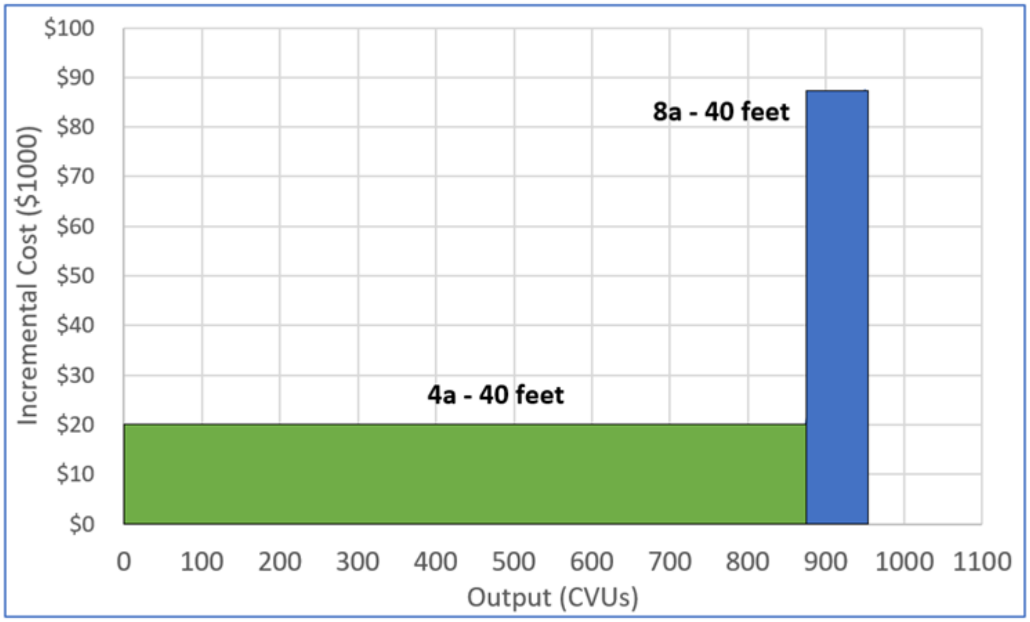

Figure 75. Incremental Cost Box Plot for Best Buy Plans without NSUs

In the model run, which included only the NSU output, alternatives 4a (40 ft) and 8b (40 ft) were both best buy plans (Table 28). Alternatives 3a-3c were not considered by the agencies during their ranking meeting because they had been screened from consideration. Alternative 8a (40 ft), which was a best buy without NSUs considered, had the same output as 8a (40 ft) but at a higher cost, so it was not cost-effective. These results reflect the input of the U.S. Coast Guard and U.S. Navy, which indicated that a depth of -40 ft MLLW was required to provide adequate logistics support. It also reflects a preference for maximizing the size of the deep-water basin to provide the most capacity, flexibility, and maneuverability for large vessels.

The incremental cost calculation results show what the incremental cost is to “buy up” to the next plan to capture the additional CVUs (Table 29). The incremental cost box plot for the best buy plans is presented in Figure 76. Incremental Cost Box Plot for Best Buy Plans with NSUs is shown in Figure 77.

Table 28. CE/ICA Outputs, NSUs-only

Plan	Annualized Cost $1000	Output	Type
No Action	**$0.00**	**0[(1)]**	**Best Buy[(1)]**
3a - 30ft	$12,514		
3a - 35ft	$16,145		
3a - 40ft	$14,629		
3b - 30ft	$12,185		
3b - 35ft	$15,874		
3b - 40ft	$14,321		
3c - 30ft	$11,681		
3c - 35ft	$15,761		
3c - 40ft	$13,813		
4a - 30ft	$15,633	200	Cost Effective
4a - 35ft	$19,019	200	Non-Cost Effective
4a - 40ft	**$17,722**	**900**	**Best Buy**
8a - 30ft	$27,190	200	Non-Cost Effective
8a - 35ft	$28,708	200	Non-Cost Effective
8a - 40ft	$28,637	1000	Non-Cost Effective
8b - 30ft	$25,852	200	Non-Cost Effective
8b - 35ft	$26,706	200	Non-Cost Effective
8b - 40ft	**$27,300**	**1000**	**Best Buy**

Notes: (1) The cells shaded in grey are for plans that did not provide adequate maneuverability in the Outer Basin to be viable. As a result, these alternatives were not scored by the national security agencies (see Appendix D [Economics] for more information).

Table 29. Incremental Cost Summary, NSUs only

Best Buy	Alternative	Annualized Cost $1000	Incremental Cost $1000	Total Output	Incremental Output	Incremental Cost/Output $1000
1	No Action	$0	$0	0	0	$0
2	Alt 4a, 40ft	$17,722	$17,722	900	900	$20
3	Alt 8b, 40ft	$27,300	$9,578	1000	100	$96

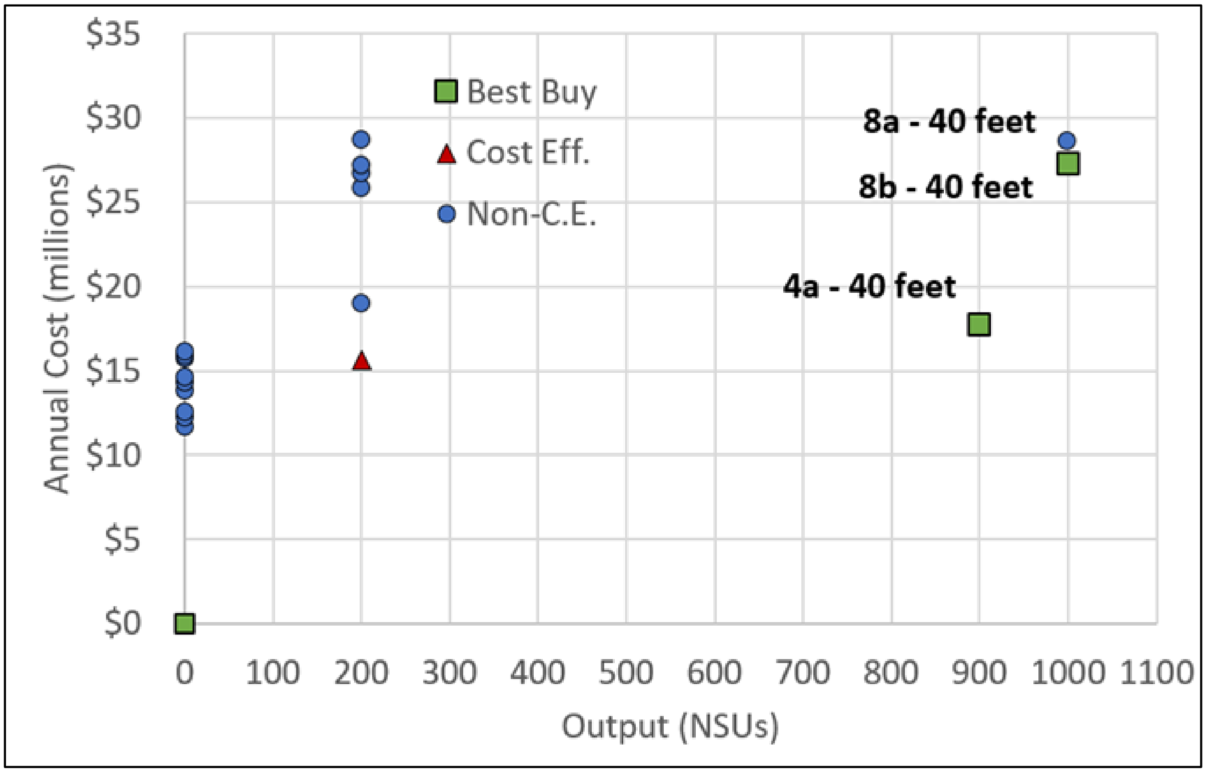

Figure 76. All Possible Plans, NSUs only

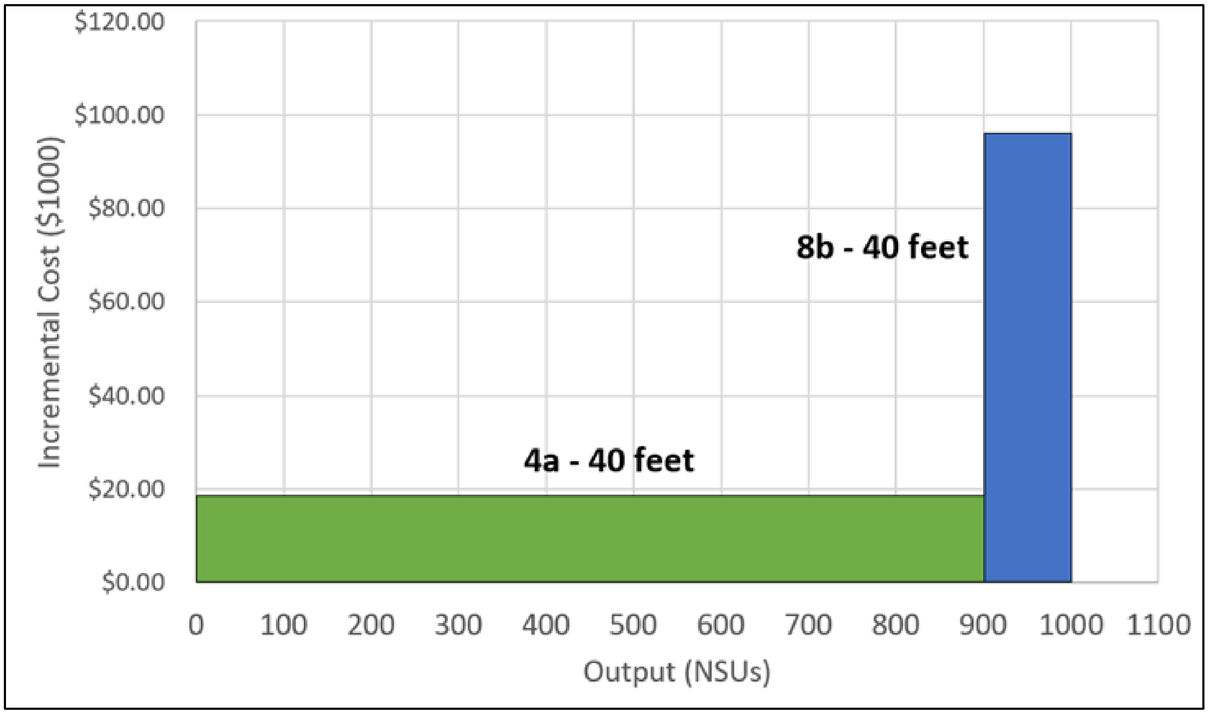

Figure 77. Incremental Cost Box Plot for Best Buy Plans with NSUs

6.6 Four Accounts Summary

The Future with Project (FWP) condition is summarized in Table 30 below. All four accounts (NED, EQ, RED, and OSE) are important for the comparison of alternatives and should be considered together.

Table 22 above displays the NED net benefit results both without and with the addition of national security benefits and shows that there is no plan that produces positive net benefits; therefore, no NED plan.

All alternatives, except Alternative 1 (No Action), would be slightly negative during construction but would offer reduction of lightering fuel and environmental impacts caused by overwater fuel transfers. Each alternative has a positive effect on RED commensurate with its construction expenditure, except for the No Action alternative.

A CE/ICA was conducted using several metrics to analyze OSE. Each alternative, other than the No Action, supports increased public health and safety, greater access to natural resources, and increased welfare of the population, adding to social and cultural value as well as regional stability. The CE/ICA resulted in two alternatives being best buy plans; 4a and 8a (all at -40 ft MLLW depths), respectively.

Table 30. Summary of NED, EQ, RED, and OSE

Alt	Deep Water Basin Dredge Depth	Net Annual NED Benefits	Net Annual NED Benefits w/ Nat. Sec.	EQ	RED	OSE (CVUs+NSUs)
1	0	1	1	Neutral	-	0
3a	30 ft	0	0	Slightly negative during construction	$2.53M	275
	35 ft	0	0	Slightly negative during construction		400
	40 ft	0	0	Slightly negative during construction		500
3b	30 ft	0	0	Slightly negative during construction	$2.44M	200
	35 ft	0	0	Slightly negative during construction		300
	40 ft	0	0	Slightly negative during construction		400
3c	30 ft	0	0	Slightly negative during construction	$2.48M	150
	35 ft	0	0	Slightly negative during construction		225
	40 ft	0	0	Slightly negative during construction		325
4a	30 ft	0	0	Slightly negative during construction	$2.80M	775
	35 ft	0	0	Slightly negative during construction		925
	40 ft	0	0	Slightly negative during construction		1775
8a	30 ft	0	0	Slightly negative during construction	$3.65M	900
	35 ft	0	0	Slightly negative during construction		1,050
	40 ft	0	0	Slightly negative during construction		2,000

8b	30 ft	0	0	Slightly negative during construction	$2.90M	850
	35 ft	0	0	Slightly negative during construction		1,000
	40 ft	0	0	Slightly negative during construction		1,950

6.7 TSP Selection Rationale

The alternatives carried forward were evaluated using the NED analysis (Section 6.4) and CE/ICA for OSE (Section 6.5) without national security benefits and with national security benefits. No NED plan was identified, and the CE/ICA without national security benefits identified three Best Buy plans (No Action and Alternatives 4a and 8a), and two Cost-Effective plans (Alternative 3a and 8b). The NED analysis and CE/ICA results for these four active plans are summarized in Table 31 and Table 32, respectively.

Table 31. NED Analysis Summary for Plans also identified as Cost-Effective or Best Buys per the CE/ICA in $1000s.

Alt.	AAEQ Benefits w/o NS	Benefits w/ NS	AAEQ Costs	Net Benefits w/o NS	Net Benefits w/ NS	BCRs[1]
3a 40[2]	$2,203	$12,873	$14,629	-$12,426	-$1,756	0.2/0.9
4a 40	$2,068	$12,738	$17,722	-$15,654	-$4,984	0.1/0.7
8a 40	$2,068	$12,738	$28,637	-$26,569	-$15,899	0.1/0.4
8b 40	$2,068	$12,738,	$27,300	-$25,232	-$14,562	0.1/0.5

Notes:
(1) The first number before the backslash is the BCR without government (national security) benefits (Gov't), and the second is with government benefits.
(2) The alternative designation includes the alternative number (3a) number and the reference to the Deep Water Basin depth (40 = -40 ft MLLW).
(3) NS= National Security also referred to as Government benefits in the Economic Appendix

Table 32. CE/ICA Summary for Plans identified as Best Buy or Cost-Effective.

Alt.	Total Cost (in $1000s)	CVUs w/o NS	CVUs w/ NS	Type w/o NS	Type w/ NS
3a 40[(1)]	$324,798	500	500	Cost Effective	Cost Effective
4a 40	$386,900	875	1,775	Best Buy	Best Buy
8a 40	$644,935,000	1,000	2,000	Best Buy	Best Buy
8b 40	$631,019,000	950	1,950	Cost Effective	Cost Effective

Notes: (1) The alternative designation includes the alternative number (3a) number and the reference to the Deep Water Basin depth (40 = -40 ft MLLW). (2) NS = National Security also referred to as Government benefits in the Economic Appendix.

Selection of the Tentatively Selected Plan (TSP) (Alternative 8b) became more complicated without an identified NED plan, and the CE/ICA is identifying several Best Buy and Cost-Effective Plans. Alternative 8b was selected over Alternative 8a because the total project cost of the former is lower by approximately $13.9 M, and both alternatives performed well in the navigation simulation. Alternative 8b was selected over Alternative 4a even with a higher total cost of approximately $244.1 M because of maneuverability and safety concerns expressed by the pilots that participated in the navigation simulation and as documented in the Alaska Marine Pilots LLC letter dated August 26, 2019 (see discussions in Section 6.2 and Appendix C, Section 4.2).

This pilot’s letter expresses safety and maneuverability concerns associated with the smaller dimension plan (specifically Alternative 4a) and the pilot concerns over the utility of Alternative 4a operations, adequacy of the entrance channels and turning basins, and unsafe conditions during turns and docking. The pilots noted that Alternative 4a does not have adequate maneuvering room and every dock must be vacated of moored vessels when large vessels are accessing the Outer Basin. While the pilots were able to successfully navigate the Outer Basin of 4a with vessels at docks, these runs required precise maneuvers that would not have been attempted with actual vessels due to damage and safety risks. The pilots also noted that a very unsafe condition of full stopping power of assist tug and vessel astern power were required with no margin for error to stop the vessel in the Deep Water Basin of Alternative 4a, and if deceleration operations were initiated too late in the dock approach or stern winds increased, there would be no means to prevent the vessel from colliding with the structure.

The use of maximum assist tug power is considered a very unsafe condition, and the USACE would recommend that more powerful tugs than those used in the ship simulations (1700 hp) are used in the new harbor; however, the availability of tugs was not studied during this effort. Both the sponsor and the pilots indicated that it would be difficult to find and sustain tugs larger than the 1700 hp size at Nome due to vessel availability and the expected frequency of use. Pilot comments during the ship simulator suggested tolerable wind speeds for navigation through Alternative 4a would be 10 knots, and wind speeds for 8b would be 20 knots. Based on the airport wind analysis, pilot wind speed requirements to navigate the harbor for 4a would be exceeded 36.3 % of the time during the open water season, whereas conditions to navigate 8b would be exceeded 2.6 % of the time.

In summary, Alternative 3a has the most NED benefits between all alternatives considered; however, there was no NED plan. Therefore, when other social effects are considered, including regional viability, Alternative 4a and 8a are best buys. Due to the results of the ship simulation, coupled with the concerns addressed by the Alaska Marine Pilots LLC letter, there are safety concerns amongst the user groups that Alternative 4a would not be the viable option. Since Alternative 4a has a similar layout to Alternative 3a or smaller plans, these also exhibit the same concern for the safety of the operator and vessel maneuverability. Alternatives 8a and 8b have similar benefits; however, since Alternative 8a has a greater cost, 8b is the preferred plan.

While it is difficult to quantify a direct link between a Nome navigation project and improvements to the viability of a community, understanding the unique nature of remote Alaska, the role of the hub port at Nome, and how improvements to the port could strengthen the resiliency of the region is critical. According to the American Society for Civil Engineers Infrastructure Report Card for Alaska, "without safe and efficient access to ports and the ocean, the main regional economic driver in many of our communities is gone." Alternative 8b, if constructed, would benefit the BSNC region because it improves navigation efficiency, which realizes the NED benefits, the Stemming-From effects described in Table 2 and would not result in safety concerns expressed by the Alaska Marine Pilots LLC. Lastly, with improved access to the villages through upgrades to the hub port, there is the potential for efficiencies to be gained when addressing the long-term viability concerns throughout the region.

6.8 Risk and Uncertainty

Remaining risks and uncertainties fall within the categories of study, implementation/construction, and operation. The remaining study risks include an accelerated study schedule (high), and finalizing a Government-to-Government Memorandum of Agreement (MOA) with Federally-recognized tribes (low). The accelerated study schedule remains a high risk because uncertainty associated with how the reviews will progress toward preparation of the final report. For example, even though the CE/ICA model has been approved, concerns associated with the connection of CE/ICA ranked variables to subsistence and regional viability have persisted throughout the study reviews. Implementation risks for dredged material management remain, although this risk is considered low. Environmental laboratory testing would take place during PED to evaluate the sediment quality for the new work dredge material. There is a risk of elevated naturally-occurring arsenic in the sediments which could potentially impact the management of the dredged material by limiting placement options. However, an impact to the preferred option of in-water nearshore placement or the off-shore deep-water disposal option is not anticipated. Land-based placement, disposal, or reuse as fill options could be impacted by elevated naturally-occurring arsenic depending on the applicable regulations governing this option. There is a low risk that future maintenance dredging operations would be impacted by this concern because of the sediment sources have not historically impacted the beach placement of the hydraulically dredged material.

A new breakwater alignment or change in dredge assumptions that could increase cost were categorized as low risk. Implementation risks regarding performing marine mammal surveys, developing an Incidental Harassment Authorization application, and coordinating the development of a Biological Opinion during Preconstruction, Engineering and Design (PED) were characterized as low to medium, with the higher risk driven by potential weather delays of field work. Operation risks were also characterized as low risk and include possible changes in the composition of vessel traffic in the area due to changes to existing laws on benthic trawling and commercial fishing or changes in oil and gas development, unanticipated sedimentation that would affect O&M, impacts of sea level change, and uncertainty whether assumptions regarding shippers' potential change in their own operations will materialize.

The specific economic risk for this project is the opportunity to realize uncertain transportation cost savings by making modifications to the port. This opportunity is triggered by the local sponsor's desire for a larger port with deeper basins and more docks that can produce the cost-savings benefit. The consequence of this opportunity being realized is a cost savings to western Alaska shippers and the Nation. In order for these cost-savings benefits to be realized, certain events must occur. First, the volume of goods moving through the port must remain steady or increase over the foreseeable future. Second, modifications must be made to the port to allow enhanced maneuverability or reduce vessel delays. This would include changes that sufficiently increase dock space, maintain cargo handling capability and capacity, maintain or improve pilot and tugboat assistance, and offer improved mitigation for accessing the port in times of severe weather. These are all necessary steps to realize these cost savings.

The benefits of modifying the Port of Nome are uncertain and are discussed in more detail in Appendix D (Economics), Section 7.5, and summarized in Table 33.

Table 33. Summary of Uncertainties and the Potential Effect

Uncertainty	Potential Effect
Future vessel fleet: Traffic would continue to get less efficient if the same types of vessels simply increased in number over time.	If shippers shifted to newer, or larger, or more fuel-efficient vessels to move the existing commodities into and around Nome, they could increase efficiencies and take advantage of economies of scale available to them with the modified port.
There is uncertainty surrounding the development of offshore oil and gas resources in the Arctic region.	If those benefits are realized, and oil and gas development occurs, then the cost savings could be very large. However, if those benefits are not realized, and no development occurs, the consequences could be as forecasted in this report--much less significant.
A large assumption in the economic analysis was that a few vessels would prefer to do their business in port at Nome, rather than at anchor off-shore. This assumption contains a great deal of uncertainty around the future change in behavior of the fleet at Nome.	It is possible that improvements to the port make larger differences than predicted in the behavior of the anchored fleet—especially the tankers and delivery vessels involved in the “floating gas station” model. If that occurs, then the magnitude of the cost savings realized could be significantly more than reported here.

6.9 Sensitivity Analysis

Congestion costs in the HarborSym model appear to be mostly driven by and most sensitive to time loading and unloading at the dock. This is shown in Figure 52, which is an example output graph from the model. For brevity purposes, only one alternative simulation is listed, but it is indicative of all other alternatives.

Therefore, any variable that affects how long vessels spend loading or unloading would have a significant effect on benefits. So, vessel traffic volumes or dock numbers would not impact benefits as much as commodity volumes or fleet composition would. This is part of the reason why there are minimal levels of congestion relief benefits associated with all of the alternatives—no matter the number or location of docks. That being said, it would take a very significant, possibly unreasonable, increase in commodity or vessel movements over the forecast period to result in enough additional benefits to justify any project alternative. Since no origin-to-destination transportation cost savings exist for these alternatives, the cost savings via congestion relief and other means cannot justify any project alternatives, in any foreseeable scenario. The only possibility would be the resurgence of natural resource activity outlined in the 2015 Alaska Deep Draft Arctic Ports Study. A sensitivity analysis is presented in detail in Appendix D (Economics), Section 7.8.

7.0 TENTATIVE SELECTED PLAN

7.1 Plan Components

The rationale leading to Alternative 8b (Figure 78) as the TSP is summarized in Section 6.7. The selection took into account the NED and CE/ICA analyses as well as the Alaska Marine Pilots letter (see Section 6.2). Alternatives 8a and 8b have similar benefits; however, since Alternative 8a has a greater cost, 8b is the preferred plan. Alternative 8a costs are higher for the most part because of the longer West Causeway extension. Alternative 8b was identified in the CE/ICA as a cost-effective plan without national security benefits and a best buy with national security benefits. Both plans modify the existing Outer Basin to make the basin larger with a wider entrance channel, create a new Deep Water Basin, and require dredging to deepen and maintain navigation channels and basins. The non-Federal sponsor intends to work with USACE during PED concerning the extension utilities to the new docks, which may include, but not limited to, electrical, fuel marine header(s), water, sewer, and associated piping.

Besides the PED phase, the General Navigation Features (GNF) that are cost-shared include:

- mobilization/demobilization for GNF related construction and dredging,
- demolition of the existing West Causeway Spur and East Breakwater,
- construction of the breakwaters,
- construction of the core of the causeways (that portion that is considered a navigation feature), and
- dredging turning basins and navigation channels.

Aids to navigation (buoys, lighting, signage, etc.) are a Federal Cost that is not cost-shared.

The Local Service Facilities are the responsibility of the non-Federal sponsor; which for this plan include, but may not be limited to:

- construction causeway- access road (LSF generally identified as the “E” and “F” and surface courses),
- dredging associated with non-Federal berthing areas assumed to be twice the design vessel width,
- dredging and backfill needed to facilitate the driving of sheet pile for docks
- construction/installation of sheet pile moorage docks, pile moorage dolphins and associated E and F fills, and D1 surface coarse
- Installation of utilities between land facilities and docked shipped required for regular and safe operation (e.g., water, electrical, signage, fencing), and utilities to support benefits (e.g., marine header and associated pipeline)

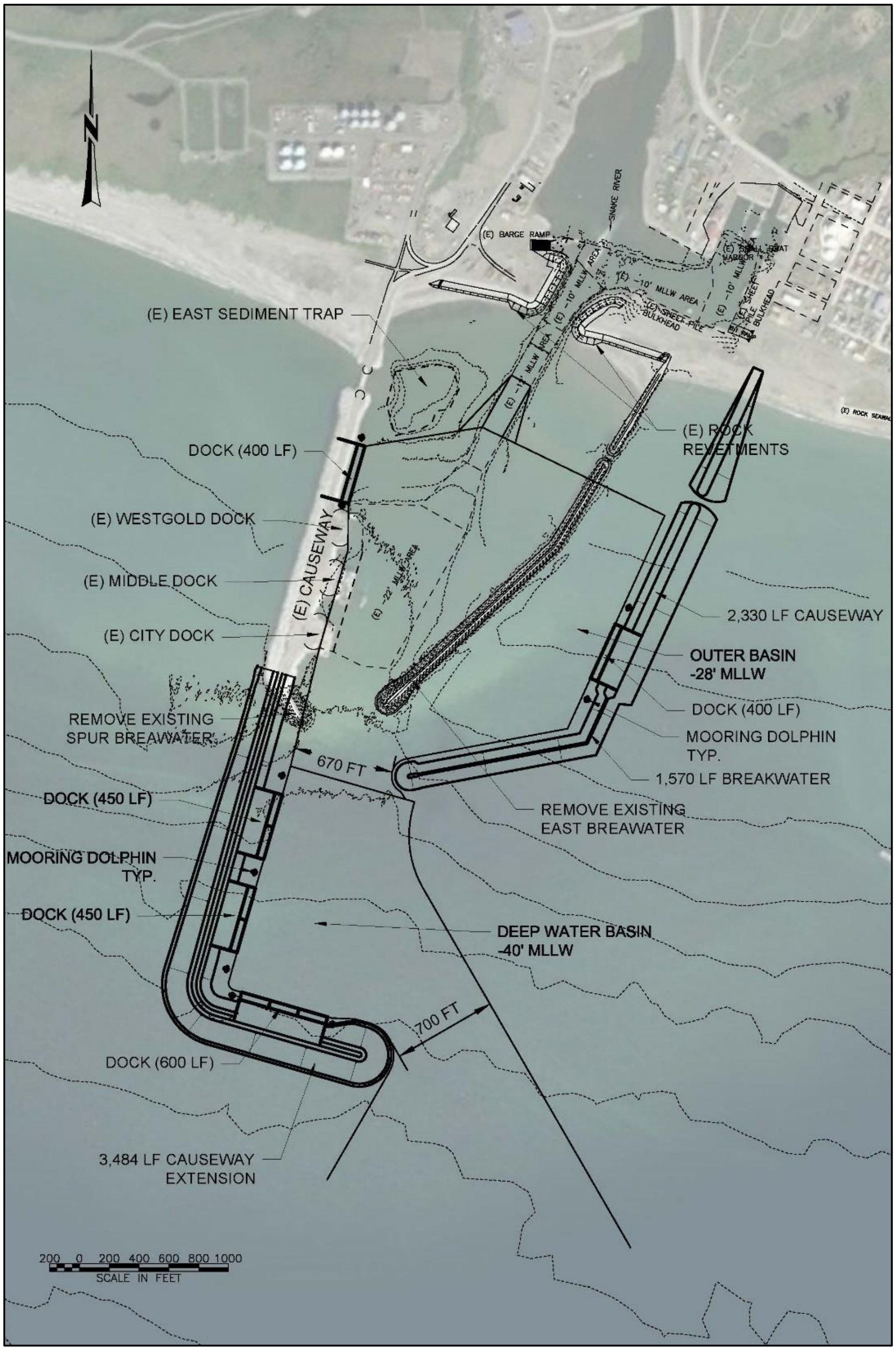

Figure 78. Tentatively Selected Plan – Concept Plan View Drawing (8b)
Note: The project area only includes the Outer and Deep Water Basins, not the Inner Basin.

The Outer Basin modifications include removing the existing breakwater stub (spur) from the south end of the existing West Causeway, extending this causeway to deep water, and increasing the entrance width to the Outer Basin. The existing east breakwater is removed, and it was assumed that approximately 75 % of the generated materials could be reused in the new project features (causeways and/or breakwaters). A new East Causeway/Breakwater combination, approximately aligned with F Street, extends to approximately -25 ft MLLW with a total length of 3,900 ft (2,400 ft causeway/1,500 ft breakwater). The Outer Basin channel entrance width increases to approximately 670 ft, and 400 ft long docks are added to the West and East Causeways. The Outer Basin is deepened from -22 ft MLLW to -28 ft MLLW. The maximum pay dredge depth in the Outer Basin is -29 ft MLLW.

The new Deep Water Basin is formed by extending the West Causeway by approximately 3,484 ft to a depth of approximately -40 ft MLLW. This extension is “L” shaped with the north-south trending section 2,100 ft long and the west-east section 1,384 ft long. The “L” shaped opening faces east, which provides wave protection for the Deep Water basin during west and south winds. Two 450-foot and a 650-foot long dock are incorporated in the West Causeway extension. The Deep Water basin is deepened to -40 ft MLLW with a maximum pay dredge to -42 ft MLLW. A summary of the plan components are presented in Table 34.

Table 34. Plan Components

Port of Nome Modification Description- Alternative 8b
<u>Outer Basin Modification Components:</u> a. Remove the existing breakwater spur from the south end of the existing West Causeway to allow the extension of this causeway to deep water and increase the entrance width to Outer Harbor. b. Remove the existing east breakwater and reuse the generated materials as applicable in other project features that would be constructed (e.g., causeways and/or breakwaters). c. Construct a new East Causeway/Breakwater combination approximately aligned with F-Street that extends to approximately -25 ft MLLW with a total length of approximately 3,900 ft (2,400 causeway/1,500 breakwater). This concept design results in an Outer Basin entrance width of approximately 650 ft d. Add a 400-foot long dock to the West Causeway north of the West Gold Dock e. Add a 400-foot long dock to the new East Causeway f. Deepen Outer Basin from -22 ft MLLW to a required depth of -28 ft MLLW (max pay depth of -29 ft MLLW), which is required to protect the existing sheet pile docks in the Outer Basin.

Deep Water Basin Components a. Extend the West Causeway by approximately 3,484 ft by constructing an "L"-shaped causeway to approximately -40 ft MLLW (north-south section is 2,100 ft long, and the west-east section is 1,384 ft long). b. Add two 450 ft docks to the north-south section and one 650 ft dock west-east section c. Dredge the Deep Water basin to a required depth of -40 ft MLLW (max pay depth of -42 ft MLLW) d. Extend utilities to the new docks (fuel marine header, water, sewer with associated piping, and electrical service)
Dredge Methods and Material Management a. New work dredging: USACE is assuming the contractor would use a mechanical dredge and barge with nearshore placement of the dredged material in front of the city seawall at depths ranging between -15 ft to –30 ft MLLW. The total dredge quantity estimate is 2,015,800 cubic yards from the Outer Basin and 517,600 cubic yards from the Deep Water Basin (total volume = 2,533,400 cubic yards. b. Maintenance dredging: The current method of using a hydraulic dredge to remove material and then pumping it for direct placement on the beach in front of the City seawall is expected to continue. The annual dredge quantities are estimated at 88,000 cubic yards for the Outer Basin and 16,000 cubic yards for the Deep Water Basin.

7.2 Project Implementation

Project components and implementation are summarized below with additional information provided in Appendix C (Hydraulic Design), Chapters 5 and 6, as well as Appendix E (Cost Engineering).

7.2.1 Breakwaters, Causeways, and Docks

The breakwater and causeways use several layers of stone armor to achieve wave protection and filtering criteria. Placement of stone is typically performed by equipment mounted on a barge with some access provided by road. Fill prisms, and "C" rock layers are randomly placed and controlled by construction survey with larger stone, typically "B" rock and "A" rock layers placed selectively by an excavator.

Steel sheet pile modified diaphragm docks are proposed for docks within the Outer and Deep Water Basins. The new docks would have lengths of 400, 450, or 600 ft depending on location. The widths of the sheet pile docks would range from 93 ft wide to 145 ft wide and consist of PS27.5 or PS31 steel face sheets and tail wall anchor pile sheets driven into sand and gravel backfill. Existing seabed materials within the footprint of the dock would be removed to a depth two feet below the lowest elevation of piling and backfilled with quarry spalls to ensure that the piles can be driven to depth. Face sheets would have a tip elevation ranging from -34 ft MLLW to -47 ft MLLW, tail wall sheets would be stepped down at one-foot increments to a minimum elevation of two feet below the face sheets, and anchor pile sheets would be driven to the minimum elevation of the tail wall sheets. Fenders, mooring bollards, and anodes for corrosion protection would be provided prior to construction, the existing rock on the existing causeway side slope would be removed and salvaged. Final design with embedment depth and lengths would be determined after the geotechnical investigation scheduled for PED. The non-Federal-sponsor is assuming at this time that the USACE would design and install the docks and moorage dolphins

7.2.2 New Work Dredging and Material Placement

New work dredge material totals are approximately 2,015,800 cubic yards from the Outer Basin and 517,600 cubic yards from the Deep Water Basin for a total of approximately 2,533,400 cubic yards. New work dredging is assumed to require mechanical dredging equipment to reach design depths. A scow would be loaded and used to deliver and place the dredged material in water in front of the sea wall area east of the port between bathymetric contours of -15 ft MLLW to -30 ft MLLW. At this depth, the wave and current energy should migrate some of the dredged material to nourish the beach. Some of the placed dredged material (gravels/boulders) may be too heavy to migrate and nourish the beach laterally. The placement area is about 30 acres (2,000 ft wide and 670 ft long). The top of the long mound over the placement area should not be shallower than -15 ft MLLW, so a cross-section of the mound would show it as a wedge with the thin edge nearshore and the thicker as the bathymetry deepen.

7.2.3 Utilities

Utilities between land facilities and the docked ships are required for regular and safe operation (e.g., water, electrical, signage, and fencing), including utilities to support benefits (e.g., marine header and associated pipeline). The design and installation of these utilities would be negotiated with the non-Federal sponsor during PED.

7.2.4 Construction Staging Areas

The City of Nome has identified the approximate boundaries of city property at the port that may be available for staging project equipment and materials prior to and during construction (Figure 79).

Figure 79. Potential Construction Staging Areas.

7.3 Operations and Maintenance

The non-Federal sponsor would be responsible for the operation and maintenance of the completed mooring areas and LSF features, which generally includes every project feature except navigation channel dredging and navigation aids, including breakwaters, as discussed in Section 7.1. LSF features include, but may not be limited to the causeways, dredging at the berthing areas, and utilities. The Federal Government would be responsible for maintenance of the causeway extension and breakwaters (except for the road prism and surfaces, docks, and other LSF features) and the entrance channel portions of the project. The Alaska District, USACE, would visit the site(s) periodically to inspect the causeways and breakwaters and perform hydrographic surveys to evaluate whether the predicted annual maintenance dredging schedule is warranted for the entrance channel and maneuvering areas.

No significant loss of stone from the rubblemound structures is expected over the life of the project. In the worst case, it is estimated that 2.5 % of the armor stone would be replaced every 25 years, with little to no armor stone degradation anticipated. The steel sheet pile docks would require replacing anodes on an estimated 15-year cycle. For the mooring dolphins, the anodes would be replaced on an estimated 15-year cycle.

Annual maintenance dredging is expected to be minimal over the course of the design life of the project. The first maintenance dredging of the existing -22-foot MLLW area occurred in 2014, 8 years after its initial construction in 2006. Annual maintenance dredging has been performed every year since 2006. Littoral transport of sediments generally appears to be from west to east under the bridge and into the east sediment trap. The inner harbor entrance channel cut through the sand spit appears to capture material not deposited in the east sediment trap where it is maintenance dredged annually.

Annual maintenance dredging in the Outer Basin navigation channel, maneuvering basin, and sediment trap would generate approximately 88,000 cubic yards, with the Deep Water Basin generating approximately 16,000 cubic yards. Characteristics of the material encountered during maintenance dredging should be similar to the current sediment type (sand) dredged from the existing navigation channel and sediment trap. As a result, hydraulic cutter head dredging equipment with pipe-line discharge would be used for maintenance dredging, with the sediment being placed directly onshore as currently practiced at the Port of Nome.

7.4 Aids to Navigation

As part of the construction of the project, concrete navigation marker bases would be constructed at the heads of the new causeways and/or breakwaters. Final coordination with the USCG Aids to Navigation Office would be conducted during PED to ensure that necessary marking of the new entrance channels are considered. See Appendix C (Hydraulic Design), Section 6.6 for more details concerning navigation aids anticipated for this project.

7.5 Construction Schedule and Sequencing

The total estimated performance period for construction the project is a minimum of 3 years and likely would be 4 to 6 years. The duration of each summer construction season is estimated to be 4 months (mid-June through mid- October). Winter construction is not anticipated. Construction scheduling would be required to avoid conflict with the continued use of the existing port and harbor facilities. The existing dock facilities, causeway access road, fuel lines, water lines, power, navigation channel, and small boat harbor would remain operational during construction.

Major construction features for Alternative 8b include rubble-mound west causeway extension, new rubble-mound east causeway, spur breakwater demolition, main breakwater demolition, dredging, sheet pile docks, and extension of fuel, water, and power lines. Project specifications would detail time restrictions for the contractor to conduct certain activities during specified time periods.

Construction sequencing would likely be similar to the following:

- Stone production in the quarry and dock footprint dredging and backfill
- Partial construction of the causeways to provide wave protection for the sheet pile dock construction and dredging.
- Concurrent demolition of the existing spur breakwater and main breakwater head would likely take place with the salvaged armor stone incorporated into the new construction.
- New work dredging and material placement
- Sheet pile dock construction could begin following completion of the causeway extension
- Completion of the causeway harbor-side placement would take place after the sheet pile dock construction.
- Extension of fuel, water, and power lines would likely take place throughout causeway and dock construction.

7.6 Locally Preferred Plan

The non-Federal sponsor has not identified any additional features that would result in a locally preferred plan.

7.7 Cost-Sharing

Project cost-sharing of the general navigation features is based on “Project First Cost.” Project First Cost is the monetary outlay of constructing the project, brought to the effective price level (FY2020), and does not include inflation. This financial cost is different than an economical cost used in BCRs for alternative selection. Economic costs include all of the opportunity costs, both explicit (Operation, Maintenance, Repair, Replacement, and Rehabilitation (OMRR&R) and associated LSF costs) and implicit (IDC) of using the resource. The project cost breakdown for Alternative 8b at a depth of -40 ft MLLW for the Deep Water Basin and -28 ft MLLW for the Outer Basin is listed below.

7.7.1 Project Cost Breakdown for Alternative 8b at -40 ft MLLW based on DEC 2019 prices

a. Project First Cost. The estimated project first cost is $491,126,200, which includes the cost of constructing the general navigation features and the value of lands, easements, rights-of-way, and relocations estimated as follows: $491,108,000 for channel modification and dredged material placement; and $18,200 for the value of lands, easements, rights-of-way, and relocations (except utility relocations) provided by the non-Federal sponsor.

b. Estimated Federal and non-Federal Shares. The estimated Federal and non-Federal shares of the project first cost are $368,331,000 and $122,777,000, respectively, as apportioned in accordance with the cost-sharing provisions of Section 101 of WRDA 1986, as amended (33 U.S.C. 2211), as follows:

   (1) The costs for the deepening of the general navigation features from -22.5 ft MLLW to -28 ft MLLW in the Outer Basin) and -40 ft MLLW in the Deep Water Basin would be shared at the rate of 75 % by the Government and 25 % by the non-Federal sponsor. All dredging is between the depths of -20 ft MLLW and -50 ft MMLLW. Accordingly, the Federal and non-Federal shares of the estimated $491,108,000 cost in this zone are estimated to be $368,331,000 and $122,777,000, respectively.

   (2) In addition to payment by the non-Federal sponsor of its share of costs as estimated and addressed in subparagraph (1) above, the estimated non-Federal share of $122,795,200 includes $18,200 for the estimated value of lands, easements, rights-of-way, and relocations (except utility relocations) that it must provide pursuant to Section 101(a)(3) of WRDA 1986, as amended (33 U.S.C. 2211 (a)(3)).

c. Additional 10 Percent Payment. In addition to the non-Federal sponsor’s estimated share of the project first cost determined in (b) above, pursuant to Section 101(a)(2) of WRDA 1986, as amended (33 U.S.C. 2211 (a)(2)), the non-Federal sponsor must pay an additional 10 % of the cost of the general navigation features of the project in cash over a period not to exceed 30 years, with interest. The additional 10 % payment is estimated to be $49,112,620 before interest is applied. The value of lands, easements, rights-of-way, and relocations provided by the non-Federal sponsor under Section 101(a)(3) of WRDA 1986, as amended (33 U.S.C. 2211 (a)(3)) would be credited toward the payment of this amount.

d. Associated Costs. Estimated associated costs of $119,778,000 include $119,693,000 in non-Federal costs associated with the development of local service facilities (including dredging of berthing areas) and $85,000 in Federal costs associated with aids to navigation (ATONS).

The project first cost summary cost-share for each alternative plan cost-share is presented in Table 35.

Table 35. Cost Share Summary based on Project First Cost at -40 ft MLLW

Description	Total	Federal	Non-Federal
General Navigation Features (deeper than -20FT but less than -50FT MLLW)	$491,108,000	$368,331,000	$122,777,000
LERR	$18,200		$18,200
Project Cost Apportionment	$491,126,200	$368,331,000	$122,795,200
10 % over time adjustment (less LERR)*		($49,112,620)	$49,112,620
Final Allocation of Project First Costs	$491,126,200	$319,218,380	$171,907,820
Aids to Navigation (ATONS)	$85,000	$85,000	
Local Service Facilities			$119,693,000
Non-Federal Total Costs			$291,600,820
*10 % over time adjustment ($491,126,200 GNF x 10 % = $49,112,620- $0 = $49,112,620)			

Note: Costs at the FY20 price levels and discount rate of 2.750 %. Cost sharing estimates are not based on certified cost until after the recommended plan costs are certified.

The non-Federal sponsor is self-certifying their ability to pay at this time. The self-certification and letter of intent is presented in Appendix G.

8.0 FUTURE WITH PROJECT / ENVIRONMENTAL CONSEQUENCES*

8.1 Assumptions

ER1105-2-100 states. "Since benefits attributable to each alternative would generally be equal to the difference in the total transportation costs with and without the project, the assumptions stated for the without project condition are used to establish the with-project condition for each alternative" (USACE 2000).

There are changes in the assumptions from the future without-project (FWOP) condition beginning with non-structural measures. For instance, not all vessel lightering and transshipment activities would continue in the manner they currently occur. Cargo vessels would continue to lighter and transship cargo at docks inside the Port of Nome. But fuel lightering operations that are currently occurring offshore would be somewhat affected by the project.

Lightering currently exists offshore of Nome for two reasons. First, tankers making deliveries to the region, including Nome, are draft restricted at the Nome City Dock.

Deliveries to the City Dock are shipped to the Nome Joint Utility System for power generation, Bonanza Fuel Inc., and Crowley Fuels, LLC for local retail sales, which is trucked to the airport.

If the draft of the port were increased, those modifications are assumed to reduce these lightering calls to the port. This reduction would be replaced by tanker import calls. The number of tanker calls would depend on where the tankers go on their voyage and the structure of the annual refueling contract with the various communities in western Alaska.

The second reason fuel lightering occurs around Nome is for delivery of fuel from large tankers to either smaller tankers or regional delivery barges, depending on their distance from the final delivery destination, as part of the “floating gas station” model. According to the shippers in the region, this operation does not consider the depth of the port a factor in its operations at this time. It is very uncertain if this consideration would change with a project in place. This operation could be negatively affected if a tanker was forced to pull into port, taking valuable time away from deliveries to remote locations. If regional delivery barges had to pull into the Port of Nome for fuel shipments, instead of receiving it offshore, this could increase their travel time as well, which would increase transportation costs and, ultimately, fuel prices at remote delivery points in the region. There are also additional financial costs incurred by using Nome as a hub, instead of continuing the offshore lightering operation. The City charges a 3.5¢ per gallon inbound fee on imports and 1.2¢ on exports of fuel, which would increase the transportation cost of regional fuel deliveries by adding another handling location to the process. Any new tugboat or pilotage fees would impact transportation costs as well.

However, it is not certain if vessels would conduct fuel transfers faster offshore than they could pier side. Many factors play a role in how quickly these operations can be conducted, including weather, sea state, crew proficiency, increased safety considerations, type and age of equipment, etc. So, it could possibly save both tankers and more local regional delivery vessels time by conducting their transfers via the Port of Nome, even if the financial costs of doing so are increased with port fees. In that case, port modifications would have an impact on the “floating gas station” model, and some offshore lightering tankers would call on the port of Nome instead to conduct their business onshore.

In light of this uncertainty, this analysis would present a range of cost savings that capture two scenarios.

The first assumes that the only vessels that would be enticed to transfer fuel ashore are those who were lightering to the port itself, not transshipping fuel to remote locations in the “floating gas station.” This is not an unreasonable scenario given the feedback from multiple shippers in the Nome area. They do not see a port expansion as affecting their operations at this time.

The second scenario would assume that some tankers would be enticed to transfer fuel ashore, rather than at anchor. “Floating gas station” tankers typically carry over 9 million gallons of fuel to be transshipped around the Nome area. For example, the Glenda Meryl, a 47,000 DWT tanker that was anchored offshore of Nome for 44 days in 2016, offloaded 9.6 million gallons to other vessels during that time. The port has a total of 12.4 million gallons of storage capacity for fuel. Therefore it is unlikely that tankers would offload their entire cargo ashore. Historically, Nome receives about 6 million gallons of fuel each summer to satisfy its various demands. The number of tankers that may be enticed to transfer fuel ashore is assumed to be 6 per summer, at 1 million gallons each call. This would not be the tanker’s full delivery to the region, but would represent an estimate of the efficiency they would gain due to the project modifications and expected landside capacity. Tankers would still need to transfer fuel at anchor around the region to meet existing demand.

Vessels that are approaching their underkeel clearance tolerances would still need to wait for favorable tides in order to call on the port. This tolerance would remain at 5 ft, but the arrival drafts would deepen with the corresponding change in with project depths.

There are currently no plans to improve the harbor or channels being undertaken by the Port of Nome. The City has recently acquired new lands, and there are plans to acquire additional uplands for cargo storage and vessel overwintering, and that is assumed to occur in the future.

The fuel storage facilities at Nome have sufficient capacity at their respective locations for the amount of fuel moved in and out of the port at this time. However, future volumes of fuel would require an increased level of fuel storage over the period. Since existing petroleum operators are already preparing for storage expansion, it is safe to assume that the existing storage would be expanded as demand dictates, and without consideration to project alternatives.

All vessels are assumed to experience a time savings “with” project in the form of the reduction in transit time delays. Other costs and practices, such as landside handling costs, would not change as a result of the project and are assumed to remain constant.

8.2 Economic and Political Conditions

8.2.1 Waterborne Commerce

The volume of commerce through the Port of Nome is expected to remain the same as forecasted in the FWOP condition. Regional growth would drive the need for increased levels of cargo shipped in the future; however, the proposed alternatives are not estimated to further affect the demand for fuel, gravel, or dry cargo in the region.

Current forecasted rates of growth for each of these commodities take into account normal business cycle fluctuations and reflect long-term trends.

8.3 Vessel Traffic

The vessel fleet calling on the Port of Nome in the future with-project condition is also assumed to grow with the natural increases in global shipping over the forecast period. Arctic shipping is forecasted to follow the increasing trend of global economic growth, and as mentioned before, regional growth would also drive the need for increased levels of cargo shipped in the future. However, in the with-project condition, the deepening and widening of the port and its berths would drive additional changes in the vessel fleet calling on Nome.

Currently, multiple government vessels, large cruise ships, and larger research vessels conduct business in Nome while anchored offshore in deeper water. This business includes the transfer of personnel and equipment to and from the ships. The airport and various retail locations in town help facilitate these much-needed logistical stops offshore. With the project in place, these vessels would be able to conduct their business pier side, instead of offshore. These new vessels include a fleet of ice breakers used by public and private entities to conduct polar research or commercial ice-breaking for oil and gas traffic through the Northern Sea Route. These vessels spent over 1200 hours at anchor offshore of Nome in 2017 alone. These new vessels also include a larger class of cruise vessels. Nome already receives multiple calls from medium-size cruise ships each summer that tour the Alaskan coast for whale watching, glacier visits, and other opportunities. In 2016 and 2017, a much larger class of vessel transited the Northwest Passage around Canada from the U.S. East Coast as part of a destination cruise package. With a project in place, this type of destination cruise would become more frequent as passenger transfer can occur on a much larger scale inside the port of Nome via the airport. The reduction in sea ice through the Northwest Passage would also help facilitate these types of cruises.

Just as in the without-project condition, the future vessel fleet was forecasted by conducting a load factor analysis for each vessel class and each commodity that they moved through the port. In discussions with the fuel and cargo shippers that use the port of Nome, none have indicated a pending shift to larger or different kinds of vessels. Low population growth and historic demand for fuel and cargo lead them to believe that the current fleet is sufficient for the foreseeable future. This fleet, except fuel tankers, would not benefit from an increase in depth; therefore, their load factors are not expected to change with a project.

Fuel tanker imports able to access a deeper port are anticipated to increase the load factor for fuel imports with a project in place. This is because the additional depth would allow them to eliminate some of the lightering calls into the port by loading deeper.

Also, the addition of new classes of vessels were included in the with-project load factor analysis. These three classes were Ice Breakers, Large Cruise Ships, and Large Research Vessels. These vessels would only be moving fuel exports as they refuel inside the port of Nome. Load factors for these export movements were matched with the most similar vessel class already calling at Nome. For example, Ice Breakers were matched with the Government Cutter fleet, Large Cruise Ships with Medium Cruise Ships, and Large Research Vessels with Medium Research Vessels. There is no reason to assume that these new classes would be loaded much differently than those already calling on Nome.

There is currently no new technology on the horizon that could alter the way these vessels operate. Just as in the without-project condition, rule changes for vessel fuels would not drive vessel changes in this scenario. Once this analysis was completed for each class and each commodity, then a total number of vessel calls were estimated over the 50-year forecast period (Table 36).

Similar to the commodity forecasts, after the initial 20-year period, growth was held constant for the remaining 30 years. So, the level of vessels in 2050 to 2079 would remain unchanged.

Table 36. Future With-Project Vessel Fleet Calling at the Port of Nome by Class and Year

Vessel Class	2030	Vessel Class	2040	Vessel Class	2050
Small Tug & Barge	67	Small Tug & Barge	83	Small Tug & Barge	104
Medium Tug & Barge	41	Medium Tug & Barge	52	Medium Tug & Barge	62
Large Tug & Barge	27	Large Tug & Barge	31	Large Tug & Barge	37
Tanker	18	Tanker	22	Tanker	29
Cutter	14	Cutter	19	Cutter	26
Buoy Tender	2	Buoy Tender	3	Buoy Tender	4
Ice Breaker	2	Ice Breaker	8	Ice Breaker	10
Large Cruise Ship	1	Large Cruise Ship	2	Large Cruise Ship	2
Medium Cruise Ship	8	Medium Cruise Ship	10	Medium Cruise Ship	13
Small Research Vessel	27	Small Research Vessel	36	Small Research Vessel	49
Medium Research Vessel	20	Medium Research Vessel	26	Medium Research Vessel	35
Large Research Vessel	2	Large Research Vessel	3	Large Research Vessel	4
Small Landing Craft	3	Small Landing Craft	3	Small Landing Craft	4
Large Landing Craft	26	Large Landing Craft	32	Large Landing Craft	38
Miscellaneous	29	Miscellaneous	39	Miscellaneous	52
Total	**287**	**Total**	**369**	**Total**	**469**

8.4 Planned Development (With Implications for this Project)

The fuel storage facilities at Nome have sufficient capacity at their respective locations for the amount of fuel moved in and out of the port at this time. However, future volumes of fuel would require an increased level of fuel storage over the period. Since existing petroleum operators are already preparing for storage expansion, it is safe to assume that the existing storage would be expanded as demand dictates, and without consideration to project alternatives.

8.5 Summary of the With Project Condition

The FWP condition utilized for economic analysis is a forecast of the expected vessel fleet to utilize marine facilities at Nome, based on forecasts of commodity transfers (e.g., fuel), and natural resource extraction activities (e.g., gravel, stone, precious metals, and other minerals). The number of transits through the Arctic does not ultimately affect this study’s without-project condition; however, the Arctic has become more ice-free during the summer season, and as a result, frequency of large vessel traffic has continued to grow, and the potential for these vessels to call at a deep draft port at Nome should increase whether it is for commerce or other reasons such as emergency repairs.

8.6 Design Vessel

A fleet spectrum was developed for the Port of Nome for the FWP condition as outlined in the Appendix D (Economics), Chapter 6 with design vessel information presented in Appendix C (Hydraulic Design), Chapter 3. Expected fleet activities included the delivery of fuel and freight to Nome and trans-shipment to surrounding communities and mineral resource extraction exports from Nome. Secondary fleet activities include search and rescue, and arctic research. Design vessel consideration was based on past vessel activity and the objective of reducing the amount of lightering currently taking place to deliver fuel and freight to the Nome. A summary of the design vessel information is presented in Table 37.

Table 37. Design Vessel Information

Vessel Activity	Comments	Vessel Dimensions		
		Length (ft)	Beam Width (ft)	Maximum Draft (ft)
Bulk Fuel (import)	Handi-size Tankers similar to: Maersk Belfast and	575	96	31.2
	Chembulk New Orleans	572	91	34.9
Freight and Supply	Typical barge	400	Not reported	14
	Tugs	74 to 200	Not reported	12 to 20
Resource Extraction /Export	Shipments by the barge fleet that currently access the harbor or lightering to deeper draft barges	Barges of similar size used for freight and supply		
Search and Rescue	Vessel dimensions derived from an analysis of the domestic and foreign ice breaker fleet operating in the arctic	548	74	30
Arctic Research	Vessels owner /name: NOAA / Fairweather NSF / Sikuliaq	231 to 261	Not reported	16 to 19

Tankers and /or barges accessing the port currently deliver fuels through a pipeline to upland storage tanks that supply Nome and local communities with motor vehicle fuels, jet fuel, and heating oil. Freight is delivered by barge. A portion of this fuel and freight is exported to the region. Currently, the vessels delivering fuel and freight are typically shallow-draft vessels due to the limited depths of the existing harbor. Currently, deeper draft vessels either arrive light loaded or lighter in the goods into the port. Some transship of these goods occurs offshore by offloading to shallow-draft barges that deliver to the region. With deep draft docks in the FWP condition, deeper draft vessels can enter the Deep Water Basin to deliver or receive higher cargo and fuel volumes to the port. There is also the potential of reducing the risk of off-shore spills, with reduced lightering.

The resource extraction industry is expected through the export of gravel and rock, and potential future export of graphite through the port. Barges of similar size as those used for shipment of freight would be used the make regional deliveries and lightering operation would likely be used to transfer these mined materials from the port to deep draft bulk carriers moored offshore for international delivery.

Search and rescue and arctic research vessel dimensions appear smaller than the tanker dimensions (see Table 37); as a result, these vessels would not be an overriding design consideration for a deep draft harbor assuming adequate draft and dimension are designed for the potential fuel tanker fleet. Currently, multiple government vessels, large cruise ships, and larger research vessels conduct business in Nome while anchored offshore in deeper water. This business includes the transfer of personnel and equipment to and from the ships. The airport and various retail locations in town help facilitate these much-needed logistical stops offshore. With the project in place, these vessels would be able to conduct their business pier side, instead of offshore. These new vessels include a fleet of ice breakers used by public and private entities to conduct polar research or commercial ice-breaking for oil and gas traffic through the Northern Sea Route. These vessels spent over 1200 hours at anchor offshore of Nome in 2017 alone. These new vessels also include a larger class of cruise vessels. Nome already receives multiple calls from medium-size cruise ships each summer that tour the Alaskan coast for whale watching, glacier visits and other opportunities. In 2016 and 2017, a much larger class of vessel transited the Northwest Passage around Canada from the U.S. East Coast as part of a destination cruise package. With a project in place, this type of destination cruise would become more frequent as passenger transfer can occur on a much larger scale inside the port of Nome via the airport. The reduction in sea ice through the Northwest Passage would also help facilitate these types of cruises.

8.7 Environmental Consequences

8.7.1 Introduction

This section discusses the potential impacts of the alternatives (discussed in Chapters 5 through 7) upon the environmental resource categories described in Chapter 3, including the agency's preferred alternative (Alternative 8b/the TSP) and the no-action alternative.

Regulations on NEPA analyses state that the document should, "based on the information and analysis presented in the sections on the Affected Environment and the Environmental Consequences"… present the environmental impacts of the proposal and the alternatives in comparative form, thus sharply defining the issues and providing a clear basis for choice among options by the decision maker and the public" (40 CFR § 1502.14). However, as will be shown in the following sections, the six structural alternatives brought forward for analysis are, from an environmental perspective, quite similar to one another. The alternatives would each impact the same environmental location and resources, in the same manner, differing incrementally in the magnitude, extent, and duration of those impacts.

Within each resource category, the magnitude of the effects upon that resource are evaluated using these criteria (where relevant) and best professional judgment, and tiered as follows (Doub 2014):

- Minor: effects are not detectable or are so minor that they would neither destabilize nor noticeably alter any important attribute of the resource.
- Moderate: effects are sufficient to alter noticeably, but not to destabilize, important attributes of the resource.
- Major: Environmental effects are clearly noticeable and are sufficient to destabilize important attributes of the resource.

The greatest direct impacts from project construction on most resource categories would be caused by:

- Placement of rock for new rubblemound structures;
- Deepening of the seafloor by dredging;
- Placement of dredged material.
- Driving of sheet pile and hollow steel pile.

Table 38, Table 39, and Table 40 presents the comparison of the magnitude of various construction activities amongst the alternatives.

Table 38. Comparison of alternatives – magnitude of rock placement/removal.

Alt #	Area of New Rock Placement Below MHHW (acres)	Area Vacated by Breakwater Removal (acres)	Net Area Occupied by New Rock Placement (acres)
3a	20.3	1.5	18.8
3b	19.8	1.5	18.3
3c	19.2	1.5	17.7
4a	35.3	3.5	34.0
8a	61.8	6.9	54.9
8b	57.3	6.9	50.4

Table 39. Comparison of alternatives – magnitude of dredging.

Alt #	Outer Basin Dredge Depth (max pay)*	Deep Water Basin Dredge Depth (max pay)*	Total Volume of Construction Dredging (cubic yards)	Total Area of Construction Dredging (acres)
3a	-29 ft	-32 ft	662,000	71
		-37 ft	942,000	90
		- 42 ft	1,545,000	124
3b	-29 ft	-32 ft	499,000	61
		-37 ft	779,000	80
		- 42 ft	1,382,000	114
3c	-29 ft	-32 ft	469,000	61
		-37 ft	749,000	80
		- 42 ft	1,352,000	114
4a	-29 ft	-32 ft	1,093,000	83
		-37 ft	1,373,000	101
		- 42 ft	1,976,000	136
8a	-29 ft	-32 ft	1,616,000	99
		-37 ft	1,726,000	109
		- 42 ft	2,065,000	134
8b	-29 ft	-32 ft	1,611,000	99
		-37 ft	1,767,000	117
		-42 ft	2,163,000	144

*Note: The “max pay” represents the project depths plus an over dredging allowance.

Under the No Action alternative, annual maintenance dredging would continue within the existing Inner Harbor and Outer Basin. The existing federal dredging limits encompass about 35 acres between the Inner Harbor and Outer Basin, although only a highly variable fraction of that area is dredged in any given year. The current annual maintenance dredging program typically concentrates on removing newly-deposited sand that has entered the northern portion of the Outer Basin through the causeway breach and shoaled in the sediment trap and Inner Harbor entrance channel. The quantity of material removed during annual maintenance dredging varies from year to year, dependent upon weather, funding limits, and dredging priorities, and does not necessarily reflect the amount of sediment deposited each year. In 2015, a record 116,505 cubic yards were removed in a specially-funded “catch up” dredging season that concentrated on emptying the sediment trap of previous years’ accumulation.

Table 40. Current Annual Maintenance Dredging Quantities at the Port of Nome.

Year	Volume Dredged (cubic yards)	Dredging Time (days)
2014	54,238	38
2015	116,505	56
2016	67,543	27
2017	82,520	21
2018	65,716	19
2019	28,000 (estimated)	13

The relative magnitude of pile driving required under each alternative is presented in Table 41.

Table 41. Comparison of alternatives – magnitude of sheet pile installation

Alt #	Number of New Sheet Pile Docks	Linear Feet of Sheet Pile Dock Face	Number of Mooring Dolphins
3a	3	1,450	6
3b	2	1,000	4
3c	1	600	2
4a	5	2,250	10
8a	5	2,300	10
8b	5	2,300	10

8.7.2 Physical Environment

8.7.2.1 Climate (Temperature & Precipitation)

The proposed activities would not be expected to have a detectable effect on climate. Cold temperatures of the winter months may limit work during construction of the project.

Comparison of Alternatives. None of the alternatives, including the No Action alternative, would have a detectable effect on climate.

Mitigatory Measures: None proposed

Magnitude of Effects: Minor.

8.7.2.2 Wind

The proposed activities may have a highly localized effect on wind patterns in the immediate port area, but no detectable effect on wind on a larger scale. Wind would not have an impact on the proposed elements of each alternative, with the exception of operations of the non-Federal berthing areas in the Deep Water Basin in Alternatives 8a and 8b. These berthing areas are not sheltered from an easterly wind direction, which may require vessels to leave the docks during strong easterly wind events to prevent damage to the docks. The effect is anticipated to be minor as wind direction from the north or south is more common during the ice-free months. Wind may have an overall minor impact on the construction of some elements due to high wind events temporarily restricting the use of construction equipment.

Comparison of Alternatives. The existing causeway and breakwater presumably act as windbreaks to some degree and influence wind patterns in their immediate vicinity. Extending these structures would increase the extent of their influence on such wind patterns; the larger alternatives (Alternatives 8a and 8b) would necessarily have a larger effect. Berthing areas in the Deep Water Basin in Alternatives 8a and 8b may be susceptible to damage caused by strong easterly winds battering moored vessels against the docks. All Alternatives carried forward provide shelter form the prevailing, north and south, winds during the ice-free months (see Figure 11). All Alternatives are anticipated to utilize similar dredging plant and construction equipment, with the larger Alternatives 8a and 8b requiring a longer construction duration, which has a greater potential for construction activities impacted. This is anticipated to be a minor impact and factored into the estimated construction duration.

The No Action alternative would leave the entrance to the Outer Basin open to a southerly wind direction, which is more prominent during the ice-free months.

Mitigatory Measures: None proposed.

Magnitude of Effects: Minor.

8.7.2.3 Sea Ice

The structural alternatives would likely have a small, highly localized effect on the formation and stability of sea ice in the immediate area of the harbor. The extended rubblemound causeways and/or breakwater would provide a greater anchor for shorefast ice in that area, protecting it to some degree from the shearing effects of strong winds.

Comparison of Alternatives. The anchoring and stabilizing effect on sea ice described above would be greater for the alternatives that extend the rubblemound structures farther out to sea.

The No Action alternative would provide less of an anchor for shorefast ice in the area.

Mitigatory Measures: None proposed.

Magnitude of Effects: Minor.

8.7.2.4 Bathymetry

Each of the structural alternatives would dredge the seafloor to alter the bathymetry in small, highly localized areas. The areas affected and target depths for each construction alternative are quantified in Table 22 and Table 39.

Placement of dredged material from each structural alternative would impact bathymetry within, and in the vicinity of, the placement area designated in the nearshore dredged material management option, as seen in Figure 69 and Table 19. During construction, utilization of the nearshore placement option would alter the bathymetry in the designated area to a depth not less than -15 ft MLLW. After construction material would disperse and the site is anticipated to return to a similar bathymetric profile. It is anticipated material from this site would migrate onto the beach in front of the City of Nome.

Annual maintenance dredging is anticipated to continue under all alternatives, with minor increases in average annual maintenance dredged material quantities. Maintenance material would continue to be placed on the beach and have no significant change in bathymetry compared to current maintenance dredging

Comparison of Alternatives. As shown in Table 22 and Table 39, the larger structural alternatives (Alternatives 4, 8a, and 8b) and deeper depth alternatives affect the bathymetry over larger areas. The quantity of new work dredged material generated from each alternative would impact the area that would be shallower within the nearshore placement, and in turn, affect the size of the beach due to the various quantities of sediment available to be transported from the nearshore environment to the beach. Average annual maintenance dredged material quantities between the alternatives do not significantly differ, and no impact on the size and bathymetry of the beach between maintenance cycles is anticipated among the alternatives.

Under the No Action alternative bathymetry in current and proposed channel alignments and proposed dredged material placement areas would be unchanged. Additional material would not be placed near shore or on the beach to enlarge the beach.

Mitigatory Measures: None proposed

Magnitude of Effects: Minor.

8.7.2.5 Geology

None of the alternatives, including the No Action alternative, would have a significant impact on geology, except as discussed in the Soils and Sediments section below.

8.7.2.6 Soils and Sediments

The proposed project would directly affect soils and sediments primarily through deepening of the seafloor via dredging. Mechanical and/or suction dredging would remove the silty sand surface deposits, and in some areas, extend into the underlying glacial till (gravely silty sand) deposits. Little change in surface composition is anticipated, as the silty sand veneer would rapidly re-establish itself within the active littoral zone, and dredging into the glacial till deposits is unlikely to expose the deeper marine deposits.

Under any construction alternative, the proposed placement of dredged material along the Nome waterfront would greatly increase the amount of material placed for beach nourishment relative to the current annual maintenance dredging quantities; this is true of both short term construction dredging, and of future maintenance dredging of an enlarged Outer Basin. The construction dredging is likely to place a more varied mix of fine sand, coarse sand, and gravel along the Nome waterfront than the fine silty sand currently discharged during annual maintenance dredging, but the material placed during future maintenance dredging should more closely resemble the current maintenance dredging material. This may result in a more complex and continually changing patchwork of coarse and fine materials in that area than exists now, as littoral currents and storm surge separate fine materials from less-mobile gravels.

The annual placement of maintenance dredging material at the west end of the Nome seawall has been observed to widen the beach along the toe of the seawall for a few hundred feet to the east of the discharge point, and to lessen the frequency and force of waves breaking along that section of seawall. However, no formal study examining the effectiveness of the beach nourishment placement has been completed. The largest annual volume of maintenance dredging material placed at the seawall in a single season has been 116,000 cubic yards, an order of magnitude smaller than the construction dredging volumes (see Table 39). The annual O&M dredge maintenance material typically disperses quickly in a given season along the beach in front of the town seawall (Charlie Lean, personal communication, 2019). The behavior of the large volumes of construction dredged material anticipated, when placed along the seawall, is anticipated to behave in a similar method.

Comparison of Alternatives. The area of construction dredging as well as the total dredged volume for each alternative, as well as the three depth alternatives for the deep water basin is summarized in Table 39. The larger alternatives (Alternatives 4, 8a, and 8b) and the deeper dredge-depth alternatives modify larger areas of seafloor and generate greater volumes of dredged material. The existing causeway already extends beyond the active littoral zone, so the long extensions of the causeway (Alternatives 8a and 8b) are unlikely to cause a significantly greater retention of sediment on the west side of the causeway than the shorter extensions.

The No Action alternative would have significantly less sediment available for placement nearshore or on the beach, consequentially limiting the size of the beach.

Mitigatory Measures: The intent of dredged material placement during construction is to deposit the material at multiple locations along the seawall, both to ensure that the beach nourishment benefits as much of the Nome waterfront as possible, and to minimize the creation of large, long term mounds of material. Mounds that were created by the Bima gold mining vessel and by the original harbor entrance spoils dispersed offshore all eroded flat within 20 years (Charlie Lean, personal communication, 2019).

The U.S. EPA has stated (Lohrman 2018) that placement of the construction dredged material for beach nourishment must be demonstrated to be appropriate and beneficial through sediment transport and hydrodynamic modeling studies, for the U.S. EPA to agree that the discharge is regulated under Section 404 of the Clean Water Act. Otherwise, the discharge may require the establishment of an ocean disposal site under the Marine Protection, Research, and Sanctuaries Act (MPRSA). Under section 103 of the MPRSA, the USACE is the federal agency that decides whether to issue a permit authorizing the ocean disposal of dredged materials. In the case of USACE federal navigation projects, the USACE may implement the MPRSA directly in the ocean disposal of dredged materials. USACE relies on EPA's ocean dumping criteria when implementing federal projects involving disposal of dredged material into ocean waters, and federal projects involving ocean dumping of dredged material are subject to EPA review and concurrence. Authorizations for ocean disposal may not exceed three years (USEPA 2016). Designation of a disposal site requires a rigorous and prescriptive evaluation of the proposed disposal site and of the dredged material to be discharged, which, at a subarctic location like Nome, may take several years to complete. Under current plans, the dredging prism would not be characterized for its physical and chemical composition until the PED phase, which would create a risk that an authorization for dredged material disposal would not be in place prior to construction.

According to USACE regulations (33 CFR 325.6), MPRSA permits for federal projects involving the transportation of dredged material for the purpose of disposal into ocean waters are issued for durations not to exceed three years.

Magnitude of Effect: Minor. For any of the structural alternatives, the changes to the composition of soils and sediments would be highly localized and temporary. The broadening of the beach along the Nome seawall would be an intended and beneficial effect.

8.7.2.7 Tides

None of the alternatives, including the No Action Alternative, would have a significant impact on tides. With a small tidal range, as seen in Table 3, vessels are not able to take advantage of high tides with much significance. During large storm tides, wave protection features may be susceptible to overtopping, especially when coupled with wave events. Overtopping of the wave protection features would increase the potential for erosion of the causeway and damage to dock surfaces.

Comparison of Alternatives. All Alternatives include the construction of wave protection features to varying degrees. The larger Alternatives, 8a and 8b, include additional docks and causeways that may be susceptible to damage.

With the No Action Alternative causeways and docks would not be constructed and therefore not susceptible to damage from storm tides and wave events.

Magnitude of Effect: Minor.

8.7.2.8 Currents

Dredging and construction of causeways and breakwaters have the potential for modifying current patterns and water circulation via alterations to substrate morphology. The hydrodynamics of the Port of Nome are dominated by the existing causeway and breakwater, and the incremental deepening of the seafloor within those structures is unlikely to alter water circulation or flow significantly. Dredging the new Deep Water Basin and constructing new breakwaters and causeways may cause localized changes in the direction or velocity of water flow and water circulation.

Currents would play an essential role in distributing dredged material in the nearshore and direct beach placement options. A portion of material placed in the nearshore placement area is anticipated to be transported to the beach by currents and wave action. Placement of material directly on the beach would be transported along the beach toward the east by the longshore current, as seen in current maintenance dredging practice. The enhancement of the beach through these placement options would provide temporary protection from erosion while these sediments reside on the beach and in the nearshore.

Comparison of Alternatives. Larger Alternatives would incrementally construct more extensive breakwaters and causeways that may incrementally impact localized velocity and direction of currents over a larger area. Additionally, larger Alternatives would provide larger quantities of dredged material to be placed in the nearshore and/or direct beach placement areas and enlarge the beach.

Under the No Action plan, there would be no new work dredged material available to place nearshore or directly on the beach to provide some protection of the beach from currents eroding the shoreline.

Magnitude of Effect: Minor.

8.7.2.9 Sea Level Rise

None of the alternatives, including the No Action Alternative, would have a significant impact on seal-level rise.

Sea-level rise predictions are presented in Section 3.1.8 and Appendix C (Hydraulic Design), Section 2.3.2. From these predictions, use of the low sea-level change (SLC) estimate increases the design height of the wave protection features by half a foot. If an intermediate SLC estimate occurs the wave protection features would experience half a foot of overtopping during the design level wave event. This level of overtopping would raise the possibility of erosion to the gravel causeway roads and dock surfaces resulting in higher operations and maintenance costs associated with near design level wave events. If a high SLC estimate occurs, the wave protection features would experience 2 ft of overtopping and potential inundation of the docks and causeway roads. This level of overtopping would cause inundation and erosion to the gravel causeway roads and dock surfaces, resulting in significant damage to the causeway during the design level event and higher operations and maintenance costs associated with 10-20 year return interval wave events.

Magnitude of Effect: Minor.

8.7.2.10 Water Quality

The proposed activities may directly impact water quality in the project area, primarily as a result of:

- Dredging, and the placement of dredged material;
- Accidental spills of fuel or other contaminants from project vessels and other machinery.

Dredging and dredged material placement would affect water quality primarily through the temporary suspension of seabed material into the water column, i.e., increased turbidity. Solids suspended in water have the potential to block light entering the water column, distribute contaminants from sediment into the water, deplete oxygen, and release ammonia and sulfide from seafloor sediments. The placement of rock for the rubble mound structures, and the driving of piles in to the seafloor, would also suspend sediment into the water column, but at a much lesser degree than the direct manipulation of dredged material.

<u>Turbidity.</u> The dredging is expected to be performed with a mechanical clamshell dredge, operated from a crane stationed on a barge, and depositing the dredging spoils into an adjacent scow. Alternatively, a cutter-head suction dredge (similar to what is used for annual maintenance dredging at Nome) may be used for a portion of the

dredging work. In mechanical dredging, sediment becomes suspended into the water by:

a) the impact of the dredge with the seafloor,
b) fallback of sediment as the dredge is raised to the surface,
c) dewatering of the sediment as it is stockpiled on the scow, and
d) discharge of the sediment from the scow at the placement site.

Suction dredging tends to loft less sediment into the water column at the dredging site but creates a slurry of water and dredged material that more thoroughly intermixes the sediment and water. This may cause more suspended solids to be discharged at the placement site.

The deepening of the Outer Basin and deep water basin would disturb a thin surface layer of fine sand, and several feet of the underlying glacial till deposit of gravelly silty sand (discussed in section 3.1.5). Judging by the geotechnical analyses from the few known offshore borings at Nome (Harding Lawson Associates 1982; Appendix B), the offshore glacial deposits may be expected to consist of roughly 20 % to 45 % very fine particles such as silt, with the rest being coarser sand and gravel. Silts are more easily suspended in water than sand or gravel and tend to stay suspended in the water column longer and be transported farther by currents.

As discussed in section 3.1.8, natural processes frequently cause turbid conditions in Norton Sound. The active littoral zone at Nome transports an estimated 120,000 cubic yards of sediment along the shoreline each year (see Appendix B), resulting in highly turbid nearshore water for much of the open-water season. The most relevant State of Alaska turbidity criteria (ADEC 2018b) for marine water uses at Nome are:

- Secondary Recreation (includes boating and recreational fishing): “May not exceed 25 NTU.”
- Growth and Propagation of Fish, Shellfish, Other Aquatic Life, and Wildlife: “May not reduce the depth of the compensation point for photosynthetic activity by more than 10 %. May not reduce the maximum Secchi disk depth by more than 10 %.”

None of these turbidity criteria are readily applicable to the nearshore environment near Nome. Ambient turbidity frequently exceeds 25 NTU in the project area, and photosynthesis is largely confined to seasonal and episodic blooms of phytoplankton. The use of a Secchi disk would be plagued with poor precision in high-turbidity waters, especially in the currents and wave environment at Nome.

Contaminants. As discussed in section 3.1.5, the potential for man-made contaminants in the project dredged material is very low, but the construction dredging may disturb offshore sediments with naturally occurring elevated concentrations of arsenic or other metals. The most applicable study of the potential effects of project dredging on water quality was performed in 1989 during the operation of the Bima gold dredge near Nome (MMS 1990). Seawater concentrations of several metals, including arsenic, were measured up-current and down-current of the Bima while it was in operation offshore of Nome; the study also collected regional background samples of seawater. The arsenic concentrations in unfiltered and filtered seawater samples collected in September 1989 is summarized in Table 42. The arsenic concentrations reported in unfiltered samples include dissolved arsenic plus arsenic contained in suspended sediment collected with the water sample; the arsenic concentrations reported in filtered samples include only the dissolved arsenic (filtering also removes any metal-water colloids, which should be regarded as part of the dissolved phase).

Dissolved metals are far more bioavailable than metals that are incorporated within suspended solid particles. The 1989 arsenic results summarized in Table 42 show that total arsenic concentrations in the down-current sediment plume are elevated over up-current or background, especially lower in the water column. However, when the suspended sediment is filtered from the water samples, the arsenic concentrations are comparable to those of *unfiltered* background water samples.

Table 42. Summary of results from the 1989 study of the Bima dredge turbidity plume (MMS 1990).

Sampling Location	Position in water column	Arsenic in seawater (µg/l, unfiltered)	Arsenic in seawater (µg/l, filtered)
Regional background (2 stations)	Surface	0.73 – 1.31	*not available*
	Bottom	1.10 – 1.21	*not available*
2000 meters up-current of Bima	Surface	1.12	*not available*
	Middle	1.17	*not available*
	Bottom	1.30	0.93
100 meters down-current of Bima	Surface	1.47	1.00
	Middle	14.08	0.90
	Bottom	23.18	0.78

As points of comparison, federal and State of Alaska water quality criteria (ADEC 2018b; ADEC 2008) allow the following maximum dissolved arsenic concentrations in marine water used by aquatic life:

- Acute (1-hour average): 69 µg/l dissolved arsenic.
- Chronic (4-day average): 36 µg/l dissolved arsenic.

The 1989 study (MMS 1990) also attempted a laboratory elutriate test, in which 4 parts seawater and 1 part wet sediment (by volume) were mixed in an open beaker for 30 minutes, presumably at room temperature. When this test was performed with sediment containing 67 µg/g (ppm) of total arsenic, the filtered seawater elutriate was found to contain 18 µg/l of dissolved arsenic. The elutriate was found to be slightly more acidic than the source water, which may have had more to do with the test conditions than with water-sediment interactions, and which may have encouraged the dissolution of arsenic in the sediment.

Another study conducted during Bima operations looked at the potential uptake of metals by red king crab (Jewett and Naidu 2000). Concentrations of arsenic, mercury, lead, and other metals were monitored in crabs during offshore mining in 1987 through 1990. The study concluded that the gold-dredging and its attendant disturbance of sediments did not result in elevated concentrations of metals in crab tissues.

Oxygen depletion, ammonia, and sulfide. Oxygen depletion within a body of water generally occurs when an excess amount of organic matter becomes available to microorganisms within the water column and surface sediment; the microorganisms proliferate and consume dissolved oxygen in the process of breaking down the organic matter. This is most likely to be a problem in enclosed bodies of water with poor circulation. The shallow, exposed, current-swept marine environment at Nome is unlikely to suffer from oxygen depletion of this sort. Ammonia and sulfide accumulate in sediment as anaerobic bacteria break down organic matter; these toxic chemicals can be released into the water column when that sediment is disturbed. The highly mobile sand veneer and underlying dense glacial till that would be disturbed by project dredging is unlikely to contain sufficient organic material to cause oxygen depletion, or to have generated significant ammonia or sulfide.

Spills of fuel or other contaminants. Project tugboats, survey vessels, dredges, and construction machinery may directly impact water quality through accidental spills of fuel, lubricant, or other contaminants. The contractors would be required to keep their equipment in good repair, and to prepare and abide by spill prevention plans to ensure rapid and effective response to any spills. The expanded port may indirectly create the potential for larger marine spills, as larger ships are able to enter the port; however, this should be offset by the expanded port's enhanced ability to provide services to more and larger vessels and minimize the need for offshore fuel transfers.

Comparison of Alternatives: The six structural alternatives would have very similar direct effects on water quality, differing primarily in the type of dredging being performed, and the duration of the impacts. Construction dredging would disturb consolidated seabed material, which is not well-characterized at this time and has an unknown potential to suspend fine sediment and possible deleterious substances into the water column. Maintenance dredging would remove accumulations of the mobile sand veneer, material that has been transported a considerable distance by currents, and contains little fines and no harmful concentrations of chemical constituents.

Construction dredging for Alternative 8b has been estimated to require 250 days (approximately 8 months) of dredging spread over 3 construction seasons (Appendix E). Detailed construction schedules have not been developed for the other alternatives, but construction dredging of the smaller-volume alternatives (Table 39) might be completed in a single 4-month season, proportionally-speaking. Alternatives 8a and 8b extend out of the turbid active littoral zone, and dredging beyond that zone may create more obvious additional turbidity. The larger alternatives, however, create more opportunities for more effective port management, and less offshore fuel transfers, which should benefit water quality in the long term.

Under the No Action Alternative or any of the construction alternatives, annual maintenance dredging would continue within the Inner Harbor and Outer Basin; the proposed project would not affect the influx of sediment through the existing causeway breach. As described in Section 8.7.1, the existing maintenance dredging program removes roughly 20,000 to 75,000 cubic yards each year (primarily from the northern Outer Basin and sediment traps), over the course of 21 to 38 days. Post-construction, the expanded Outer Basin would require annual maintenance dredging of an estimated 88,000 cubic yards of sediment, with the Deep Water Basin requiring an estimated 16,000 yards. The expanded annual maintenance needs would require roughly 60 days of dredging, depending upon the type of equipment used.

.**Mitigatory Measures:**

1. Prior to the start of construction dredging, representative samples of the material to be dredged would be sampled and analyzed for a broad range of potential contaminants. The material would be tested for total organic carbon, ammonia, and sulfides. An elutriate test appropriate to the anticipated construction dredging conditions would also be performed.

2. Dredging would be conducted so as to minimize the amount of suspended sediment generated. Best management practices may include:

- Avoiding multiple bites while the bucket is on the seafloor.
- No stockpiling of dredged material on the seafloor.
- No leveling of the seafloor with the dredge bucket.
- Slowing the velocity (i.e., increasing the cycle time) of the ascending loaded clamshell bucket through the water column.
- Pausing the dredge bucket near the bottom while descending and near the waterline while ascending.
- Placing filter material over the holding-scow scuppers to remove sediment from th4e return water.

3. The contractor would be required to prepare an Oil Spill Prevention and Control Plan. Reasonable precautions and controls would be used to prevent incidental and

accidental discharge of petroleum products or other hazardous substances. Fuel storage and handling activities for equipment would be sited and conducted, so there is no petroleum contamination of the ground, surface runoff, or water bodies. Equipment would be inspected on a daily basis for leaks. If leaks are found, the equipment would not be used and pulled from service until the leak is repaired. During construction, spill response equipment and supplies such as sorbent pads shall be available and used immediately to contain and clean up oil, fuel, hydraulic fluid, antifreeze, or other pollutant spills. Any spill amount must be reported in accordance with Discharge Notification and Reporting Requirements (AS 46.03.755 and 18 AAC 75 Article 3).

Magnitude of Effects: Moderate. The proposed activities would cause temporary, localized increases in turbidity in a marine environment where naturally high levels of suspended sediments are commonplace. The risk of releasing harmful substances into the water column during dredging is low, judging from previous studies, knowledge of the seafloor composition, and the absence of a history of contaminant spills in the project area. The risk of project-related spills would be controlled through best management practices.

8.7.2.11 Air Quality

The operation of construction equipment and vessels during project construction would, in the short term, add incrementally to the air pollutant emissions ordinarily generated by vessels and machinery at the Port of Nome. The tugboats, dredging equipment, and construction machinery likely to be used during project construction would be primarily diesel-powered, and comparable to existing mobile emission sources at the port. Direct, short term project-related impacts to air quality in the greater Nome area would be highly variable and transitory, where noticeable at all. The Nome area and surrounding region is designated as “unclassified” under EPA air quality regulations, as insufficient information exists to designate it as an “attainment” (i.e., compliant with ambient air quality standards) or “nonattainment” area (18 AAC 50.015). Without an air quality baseline, it is impossible to determine whether direct, construction-related emissions would cause exceedances of air quality standards within the greater Nome area.

The project would not create any new stationary sources of air emissions. Indirect, long term effects of the project on ambient air quality would be dependent on the number and type of mobile sources (i.e., vessels) that visit the expanded port, and how they are managed within the port. As is discussed previously, the completed project is not expected to cause an increase in vessel traffic relative to the no-project condition; however, the expanded port is intended to accommodate larger vessels. Larger vessels may generate more air emissions individually, but if fewer vessels are required to deliver the same volume of cargo, then overall new emissions may not increase significantly. The expanded port would offer more docking opportunities for visiting vessels. Presumably, vessels at dock for an extended period would likely power down and run off of shore utilities, an option not available to vessels forced to anchor or hold station offshore. Regardless of vessel size and emissions, the anticipated increase in cargo volume would require increased cargo handling activity, which may lead to increased particulates lofted into the air from unpaved roads and staging areas.

Additionally, the opening of the Arctic shipping routes would reduce the length of voyages, which would reduce vessel-related air pollution from traffic that would otherwise use the longer routes.

Comparison of Alternatives. The six structural alternatives would have similar direct effects on air quality, differing primarily in the duration of the effects, rather than the intensity or nature of the effects. The alternatives would likely employ the same number and types of mobile emission sources during construction, but the alternatives requiring more extensive rock work and dredging (i.e., Alternatives 4, 8a, and 8b, and the deeper Deep Water Basin depth alternatives) would require more construction seasons to complete. Alternative 8b would require an estimated 784 days of on-site construction over 5 construction seasons (Appendix E). Alternatives 3a, 4, 8a, and 8b place a new dock on the existing causeway that is closer to shore than other existing or proposed docks, potentially increasing by some marginal extent the vessel air emissions that are reaching the shore. On the other hand, the longer causeway extensions of Alternatives 8a and 8b each include three docks that are further from shore than other existing or proposed docks. Maintenance dredging of Alternative 8b would require an estimated 60 days, using dredging equipment similar to or higher-capacity than the existing dredging plant.

Under the No Action Alternative, air emissions would still increase over time as more vessels attempt to use the port or anchor offshore. Potentially positive impacts of the structural alternatives on air quality, such as greater moorage capacity for larger vessels, would not be realized. Annual maintenance dredging of the existing port requires 21 to 38 days of operating the existing cutter head suction dredge powered by 750 and 325 hp diesel engines.

Mitigatory Measures: The contractors would be required to use equipment that is in good repair and meets applicable emission standards. Best management practices such as wetting work surfaces would be applied if visible lofted dust is noted. Increased air emissions from increased post-construction activity at the port may be managed through port administrative controls and the upgrading of work surfaces, but such measures lie beyond the scope of this federal study.

Magnitude of Effects: Minor. Both direct and indirect effects on air quality would be highly seasonal, variable, and transient. No new stationary sources of air pollutants would be installed as part of the project. Any increases in air pollutants would be incremental to and of a very similar nature to existing emissions at the Port of Nome.

The proposed project site is not in a CAA non-attainment area, and the conformity determination requirements of the CAA do not apply to the proposed action at this time. None of the alternatives would noticeably alter or lead to the alteration of any important attribute of air quality in the greater Nome area.

8.7.2.12 Noise

This section addresses airborne noise and effects primarily on the human environment. Effects of underwater noise on marine mammals and fish are addressed in Sections 8.7.3.2.2 and 8.7.3, respectively.

The operation of equipment and vessels during project construction would, in the short term, add incrementally to the noise ordinarily generated by vessels and machinery at the Port of Nome (see Table 43). Most project-related noise would be low-frequency, low-amplitude sound generated by diesel machinery, and the movement of rock and other materials. The installation of sheet pile and mooring-dolphins would be a source of higher-frequency, high-energy sound during its construction, and is likely to generate the most conspicuous noise of the project.

Sound is usually measured in decibels (dB) on a relative scale. Airborne noise weighted for human hearing is measured on an “A-weighted scale,” with units of dBA. The A-weighted decibel scale begins at zero, which represents the faintest sound level that humans with normal hearing can detect. Decibels are measured on a logarithmic scale, so each 10 dB increase doubles the sound; therefore, a noise level of 50 dBA is twice as loud to the listener as a noise of 40 dBA. Typical dBA sound levels for a range of noise situations (WSDOT 2019) is presented in Table 43.

Table 43. Comparison of dBA sound levels (WSDOT 2019).

Representative Sounds	dBA	Human Reaction
Rocket launching pad	180	Irreversible hearing loss
Carrier deck jet operation Air raid siren	140	Painfully loud
Thunderclap	130	Painfully loud
Jet takeoff (200 ft) Auto horn (3 ft)	120	Maximum vocal effort to communicate
Pile driver Rock concert	110	Extremely loud
Garbage truck Firecrackers	100	Very loud
Heavy truck (50 ft) City traffic	90	Very annoying Hearing damage over time
Alarm clock (2 ft) Hairdryer	80	Annoying
Noisy restaurant Business office	70	Conversation difficult
Air conditioning unit Conversational speech	60	Intrusive
Light auto traffic (100 ft)	50	Quiet
Library Soft whisper (15 ft)	30	Very quiet
--	10	Barely audible

The proposed location of the sheet-pile dock feature is on the harbor-side of the existing causeway, roughly 75 yards south of the causeway bridge. The sheltered beach at the head of the Outer Basin is a common public-use area and is about 540 yards away. The nearest housing structure is about 850 yards away on Belmont Street. Using a standard noise-attenuation formula (WSDOT 2019), the noise from a pile-driver generating 110 dBA (measured at 50 ft away) would be expected to diminish over distance in the following manner:

- 50 ft…………………..…110 dBA
- 75 yards (225 ft)…………94 dBA
- 540 yards (1,620 ft)………72 dBA
- 850 yards (2,550 ft)………67 dBA

Indirectly, the completed project may contribute to greater ambient noise levels at the Port of Nome over time. Larger vessels would bring in greater quantities of goods, which would require greater activity of vehicles and equipment to unload and transport.

On the other hand, the extended causeway would cause some of this noise-generating activity to occur farther offshore.

Comparison of Alternatives: Injurious or intrusive noise from pile-driving is the greatest potential adverse effect of airborne noise on the human environment. The six structural alternatives differ in the numbers of sheet pile docks and mooring-dolphins included in their designs (Table 41) and would differ primarily in the duration of the effects, rather than the intensity or nature of the effects. Installation of sheet and cylindrical piles for Alternative 8b would take roughly 90 days spread over 3 construction seasons (Appendix E). Post-construction maintenance dredging of Alternative 8b would require an estimated 60 days, using dredging equipment similar to or higher-capacity than the existing dredging plant.

Under the No Action Alternative, the general noise levels at the Port of Nome would likely increase over time as the port becomes busier. Annual maintenance dredging of the existing port requires 21 to 38 days of operating the existing cutter head suction dredge powered by 750 and 325 hp diesel engines.

Mitigatory Measures: High-noise activities, such as pile-driving, can be timed to minimize impacts on residential areas. Port workers can be informed of the location and timing of high-noise activities, and offered hearing protection.

Magnitude of Effects: Moderate. Both direct and indirect effects on air-transmitted noise would be highly seasonal, variable, and transient. Most project-generated noise would be similar to and an incremental increase to existing noise levels at the Port of Nome. Conspicuous and/or potentially harmful levels of noise from specific activities (i.e., pile-driving) would be mitigated through timing and worksite safety practices.

8.7.2.13 Visual Resources

The proposed activities would have little direct or indirect effect on the visual appearance of the Port of Nome, as they consist of adding to visual elements already present (e.g., rubblemound structures) and extending them further offshore. The presence of project vessels and construction machinery would differ little visually from what is ordinarily seen at the port.

Comparison of Alternatives: The structural alternatives would not differ visually from one another to any significant degree; the size differences between the larger or smaller alternatives may not be readily apparent to a viewer on the shore. The No Action Alternative would have no effect on visual resources at the Port of Nome.

Mitigatory Measures: None proposed.

Magnitude of Effects: Minor. The structural alternatives would not differ visually from one another to any significant degree; the size differences between the larger or smaller alternatives (or the No Action alternative) would not be readily apparent to a viewer on the shore. The presence of project vessels and construction machinery would differ little visually from what is ordinarily seen at the port.

8.7.3 Biological Resources

8.7.3.1 Habitat and Wildlife

The proposed project would have highly localized direct and indirect effects on the habitat and wildlife resources discussed in Section 3.2.1. The USACE anticipates no discernable changes to regional oceanographic systems or trends as a result of the completed project. As is discussed previously, the project is not expected to cause an increase in Bering Strait vessel traffic relative to the no-project condition. The extended rock structures may cause localized changes to the formation and behavior of sea ice, perhaps anchoring a larger area of more stable shorefast ice.

The enlarged and new rubblemound structures would permanently replace a portion of existing sand and cobble benthic habitat with rocky, high-relief substrate, a habitat that is uncommon in the Nome area. Fishes in the immediate nearshore area may be displaced in the short term by construction-related disturbances. The replacement of habitat may provide opportunities for species not currently common in the nearshore area, but is unlikely to alter the overall composition of species in the long term, as the existing benthic habitat types would remain abundant in the immediate vicinity. Direct impacts to red king crab would be minimal, as construction would occur during the ice-free period when most crab have migrated to deeper offshore waters; an exception is the potential loss of cobble settling habitat for juvenile crab (see further discussion of essential fish habitat in Section8.7.3.3). As described in Section 3.2.1, the subtidal rock of the existing causeway and breakwater has developed a diverse community of marine algae, invertebrates, and fish; the new rubblemound structures would be expected to recruit similar communities. Seabirds and seals would also likely exploit the new rubblemound structure as roosts and haulouts.

Dredging would also disrupt benthic habitat in the short term, although dredged areas in water depths of 30 ft are in the influence of littoral sediment transport, and would very quickly be resurfaced in the highly-mobile sand that characterizes that zone. Dredging in deeper waters would remove an undetermined area of cobble habitat, but it is probable that the dredging would expose a new seafloor of a similar cobble, gravel, and sand mix.

Beneficial-use placement of the construction dredged material within the littoral zone is considered the practicable alternative in having the least adverse impact on the aquatic ecosystem. The recurring natural disruption of benthic sediments in this zone limits its use primarily to organisms adapted to loose, mobile substrates. The frequency and severity of benthic disruption decreases farther offshore with increasing water depth, and more complex and productive cobble-and-sand benthic communities are able to develop. Offshore ocean disposal would be a practicable alternative, but would have a greater adverse impact on the aquatic ecosystem than littoral placement; cobble-and-sand habitat disrupted by storm surge or human activity may take 5 to 6 undisturbed years to regain biological function and productivity. Upland disposal or placement of the dredged material would probably have the least impact on aquatic ecosystems (if not placed in wetlands) but is not considered practicable due to the large volume of dredged material that would have to be transported and managed onshore.

Birds using the Port of Nome area may be displaced in the short term by construction activities, but would benefit in the long term from expanded roosting and foraging structures. Birds frequenting the Port of Nome area are presumably acclimated to human activity and noise. No known nesting habitat would be affected by the proposed project.

The potential exists for marine mammals in the immediate project area to be directly affected in the short term by construction activities. Additional vessel activity during construction, placement of rock, pile-driving, and dredging would create disturbances that may displace marine mammals from preferred foraging or concentration areas and pose a potential risk of injury to marine mammals (see Sections 8.7.3.2.2 and 8.7.3.3 for further discussion of potential impacts to marine mammals, and proposed measures to avoid and minimize those impacts). In the long term, an enlarged and deepened Outer Basin may enhance its attractiveness to species (e.g., spotted seal, beluga whale) that concentrate there at certain times of year.

The proposed project would have a minimal or undetectable impact on terrestrial habitats. The construction staging areas shown in Figure 79 are primarily in locations already filled and heavily modified and currently used as parking and staging areas. The USACE does not propose to use the wetlands that appear in the large polygon northwest of the staging areas shown in Figure 79.

8.7.3.1.1 Invasive Species

Marine invasive species may become a threat in the Bering Strait region, as climatic and oceanographic changes become more apparent. Larger ships arriving from northern Asian and European ports may transport new species able to survive in the Nome area, via bilge water and hull biofouling (CAFF and PAME 2017). Iceland, at much the same latitude as the Seward Peninsula, has seen an influx of numerous invasive tunicates, crustaceans, and fish from the eastern Atlantic coast (Fernandez et al. 2014). Alaskan waters have seen few marine invasive species so far, although a potentially harmful tunicate species has been found near Sitka, and several other potential invasive species, such as the Chinese mitten crab and the European green crab, are under surveillance (ADFG 2019c, ADFG 2002).

The main terrestrial invasive species threat within Alaska is rats. Introduced rats have had devastating effects on seabird populations at remote Alaskan locations, especially on islands (Frits 2007). Nome already has an established breeding population of rats within the settled human environment, so further “rat-fall” at the Port of Nome would probably have little additional environmental impact. Other terrestrial species, such as small birds, maybe accidentally carried to Nome inside shipping containers. As with marine invasive species, terrestrial invasive species would need to come from a similar climate and environment as found at Nome to pose much risk of becoming established there.

Comparison of Alternatives. The six structural alternatives are very similar in the type and location of their direct and indirect impacts on the existing ecological habitat, differing primarily in the magnitude of those impacts. Alternatives 4a, 8a, and 8b are larger than Alternatives 3a, 3b, and 3c, and have correspondingly larger direct impacts in terms of habitat replacement. The deeper dredge depth alternatives within the Deep Water Basin remove incrementally greater areas of existing habitat but differ little qualitatively. Alternative 8b would lay down new rubble mound structures with a total footprint of 57.3 acres (Table 38), replacing sandy habitat and some hard-bottom habitat with new high-relief rocky substrate, and more than doubling the existing extent of rock substrate. Underwater video surveys of the existing causeway and breakwater (Section 3.2.1) suggest that the rock would recruit a new community of marine organisms suited to the new habitat. The demolition of the existing breakwater would remove rocky substrate from about 6.9 acres of seafloor, which would likely become part of the sandy habitat prevalent in the nearshore environment. Construction of Alternative 8b would require dredging of a total of 144 acres of seafloor (Table 39).

Under the No Action Alternative, annual maintenance dredging would continue in an area of up to 35 acres. While the impacts of the construction alternatives would be avoided, the risk of fuel spills other ecological disturbances around the port would likely increase over time as the port becomes busier and more crowded. Potential benefits to habitat from the construction alternatives, such as improved fuel-handling and vessel management at the port, would not be realized under the No Action Alternative.

Mitigatory Measures: The mitigatory measures described elsewhere in this chapter for water quality, air quality, protected species, and essential fish habitat would also serve to reduce project effects on habitat.

Magnitude of Effects: Moderate. All six structural alternatives pose potential effects on the overall ecological setting that may be noticeable but would be highly localized to the immediate project area such that they would not destabilize important attributes of the ecological setting.

8.7.3.2 Protected Species

8.7.3.2.1 Endangered Species Act

As the proposed project may affect most of the species discussed in Section 3.2.2.1 in similar ways, the evaluation of potential effects is organized here by type of effect, rather than individual species. The project may have potential short-term effects associated with construction, as well as long-term effects caused directly or indirectly by the finished project. None of the ESA-listed species (see Table 7) are known to congregate at or preferentially use habitat in the project area. Any project effects are likely to be on individual animals that are incidentally in the vicinity of construction activities or project-related vessel traffic. ESA determinations are presented in the "Magnitude of Effects" subsection at the end of this section.

Generally speaking, marine mammals face common threats from human activities:

- Noise and disturbance
- Vessel strikes
- Direct impacts from human fishing (e.g., entanglement in fishing gear)
- Indirect impacts from human fishing (e.g., competition for food resources)
- Contaminants and pollutants
- Habitat degradation caused by human activities
- Hunting and illegal killings

Direct Short-Term Effects from Construction-Related Activities

The major in-water construction activities under all alternatives would consist of pile driving, dredging material from the seabed to create and deepen navigation channels and basins, and placing rock for extended or new breakwaters/causeways. The main potential threats to marine mammals from these activities include noise and disturbance, vessel strikes, and release of pollutants. Virtually all construction work would be performed when ice is absent.

The USACE has prepared a draft Biological Assessment (BA) to evaluate in more detail the potential effects on ESA-listed species from pile driving and dredging. The draft BA is provided in Appendix J; the findings of the BA are integrated into this section.

Noise and Disturbance: The NMFS has developed comprehensive guidance on sound levels likely to cause injury to marine mammals through the onset of permanent and temporary threshold shifts (PTS and TTS; Level A harassment; 81 FR 51693). Under the PTS/TTS Technical Guidance (NMFS 2016c), the NMFS uses the following thresholds for underwater sounds that cause injury, referred to as Level A harassment under section 3(18)(A)(i) of the MMPA. These acoustic thresholds are presented using dual metrics of cumulative sound exposure level (LE) and peak sound level (PK) for impulsive sounds and LE for non-impulsive sounds (Table 44).

The NMFS is in the process of developing guidance for behavioral disruption (Level B harassment). However, until such guidance is available, NMFS uses the following conservative thresholds of underwater sound pressure levels (measured in micropascals, or μPa), expressed in root mean square (rms), from broadband sounds that cause behavioral disturbance, and referred to as Level B harassment under Section 3(18)(A)(ii) of the MMPA.

- impulsive sound: 160 dB re 1 μPa_{rms}
- continuous sound: 120 dB re 1μPa_{rms}

For air-transmitted sound, the NMFS has developed the following Level B thresholds:

- 100 dB re 20μPa_{rms} for non-harbor seal pinnipeds
- 90 dB re 20μPa_{rms} for harbor seals

Table 44. Marine Mammal Hearing Groups and Level A Acoustic Thresholds

Hearing Group	Relevant Species	Generalized Hearing Range	PTS Onset Acoustic Thresholds	
			Impulsive	Non-Impulsive
Low-Frequency Cetaceans (LF)	Humpback whale NP right whale NWP gray whale Blue whale Fin whale	0.007 to 35 kHz	$L_{pk,flat}$: 219 dB $L_{E,LF,24h}$: 183 dB	$L_{E,LF,24h}$: 199 dB
Mid-Frequency Cetaceans (MF)	Sperm whale Beluga whale	0.15 to 160 kHz	$L_{pk,flat}$: 230 dB $L_{E,MF,24h}$: 185 dB	$L_{E,MF,24h}$: 198 dB
High-Frequency Cetaceans (HF)	Porpoises	0.275 to 160 kHz	$L_{pk,flat}$: 202 dB $L_{E,HF,24h}$: 155 dB	$L_{E,MF,24h}$: 198 dB
Phocid Pinnipeds (PW)	Ringed seal Bearded seal Harbor seal Spotted seal	0.05 to 86 kHz	$L_{pk,flat}$: 218 dB $L_{E,PW,24h}$: 185 dB	$L_{E,PW,24h}$: 201 dB
Otariid Pinnipeds (OW)	Steller sea lion	0.06 to 39 kHz	$L_{pk,flat}$: 232 dB $L_{E,OW,24h}$: 203 dB	$L_{E,OW,24h}$: 219 dB

PTS: Permanent Threshold Shift: a permanent reduction in the ability to hear (i.e., injury).
kHz: kilohertz (sound frequency)
dB: Decibels, unweighted (sound intensity)
L_{pk}: Peak sound level; "flat" = unweighted within the generalized hearing range.
L_E: Cumulative sound level; "24h" = 24-hour cumulative period
LF, MF, HF, PW, OW: defined in "Hearing Group" column
(Adapted from NMFS 2016c)

The major sources of noise and disturbance expected during construction of this project are:

- project-related vessels (tugboats, barges, and scows);
- dredging;
- placement of rock material; and,
- driving of sheet pile and hollow steel piles.

Project Vessel Noise: Tugboats may generate significant underwater noise, especially when maneuvering or holding a barge in position against a dock or the shore. During a 2001 acoustic survey of Cook Inlet (Blackwell and Greene 2002), the highest level underwater broad-frequency noise recorded (149 decibels (dB) re 1µPa, at a distance of 102 meters) was generated by a tugboat docking a gravel barge. The same tug/barge combination generated a maximum level of 125 dB re 1µPa, at a distance of 190 meters, when in transit. The underwater noise level generated by a tugboat can vary greatly with the size/horsepower of the tugboat engine and whether noise-reducing features, such as propeller cowlings, are present. Diesel-powered tugs typically generate underwater noise at relatively low frequencies, roughly in the 0.02 to 1 kHz range (USACE 1998).

At 0.02 to 1 kHz, the typical frequency range of underwater noise generated by a tugboat engine (USACE 1998) places it at the lower end of the generalized hearing range of low frequency (LF) cetaceans, and below or at the very lower limit of the hearing range of other marine mammals (Table 44). The noise generated by the tugboat engine is assumed to be non-impulsive/continuous; no source of impulsive noise from the tug and barge is anticipated other than brief, incidental sounds from docking or landing. The 125 dB re 1µPa, at a distance of 190 meters, of a tug and barge in transit (Blackwell and Greene 2002) falls well below the Level A harassment (injury) acoustic thresholds for non-impulsive noise shown in Table 3, but slightly exceeds the 120 dB re $1\mu Pa_{rms}$ default conservative threshold for a Level B disturbance from continuous noise. There is the potential for LF cetaceans within a few hundred meters of proposed action-related vessels in transit to experience a Level B disturbance (behavioral disruption) due to underwater noise; other marine mammals would likely be insufficiently sensitive to the low-frequency engine noise to experience a disturbance.

Air-transmitted noise levels generated by tugboat diesel engines are comparable to those of large construction equipment, generally 70 to 100 A-weighted decibels (dBA) within 50 ft of the engine (Navy 1987; USACE 2011; Dyer and Lundgard 1983). Thornton (1975) measured in-air barge noise at levels between 88 and 93 dBA in the aft deck of two barges. These levels fall below the level B disturbance threshold for pinnipeds (excluding harbor seals).

Dredging Noise: The project dredging is expected to be performed by a combination of hydraulic suction dredging, and mechanical dredging with clamshell bucket, with the dredged material placed by scows in waters offshore of the Nome seawall. A recent study by the U.S. Army Corps of Engineers (McQueen et al. 2018) found that underwater dredging sounds are typically low-intensity (i.e., sound pressure levels of less than 190 dB re 1 µPa at 1 m) and non-impulsive, with frequencies below 1,000 kHz, and do not pose a significant risk of injury or mortality (Level A impacts) to aquatic organisms. The low-frequency sounds produced by dredging are similar to that produced by commercial ship traffic, and overlap the hearing frequency ranges of most marine animals, potentially posing a risk of temporary threshold shifts, auditory masking, and behavior response in marine mammals. However, a review by the study of available field observations found that whales and seals generally had no adverse reactions or avoidance behavior near active dredging operations, although individual walrus have been seen to be attracted to low frequency rumbling noises (Charlie Lean, personal communication, 2019). Bowhead whales sometimes exhibited avoidance or altered feeding behavior in experiments that broadcast simulated dredging sounds underwater (Richardson et al. 1990). A one-year field study evaluating avoidance behavior in harbor porpoises revealed that there might be short-term avoidance of areas near dredging activity; however, these effects were short-term, and porpoises return to the areas after the dredging activity was completed (Diederichs et al. 2010). In other observational studies, seals did not exhibit avoidance or altered behavior near dredging activities (Gilmartin 2003).

In its draft Biological Assessment (BA; Appendix J), the USACE uses hydroacoustic data from a study of a large clamshell dredge similar to what might be used at Nome. The BA estimates that the dredging would not have the potential to generate underwater noise injurious to any species and that the sound would attenuate to the 120 dB harassment threshold between 54-63 meters from the source.

Rock Placement Noise: Placement of rock material for causeways and breakwaters likewise produces low-intensity underwater sound; armor stone is typically maneuvered carefully into place rather than allowed to drop, to avoid damaging the armor stone or displacing the core material underneath.

The rock material may be placed by excavators or other heavy equipment working from barges or from shore. The intensity of air-transmitted noise from on-land construction equipment is most often expressed in decibels weighted for the human-hearing frequency range ("A-weighted" decibels, or dBA), whereas water-transmitted noise intensity is generally expressed in unweighted decibels (dB). The A-weighting convention was developed for human health and safety and emphasizes the frequencies between 1 kHz and 6.3 kHz to simulate the relative response of human hearing. Table 45 shows typical averaged maximum (L_{max}) or time-weighted (L_{eq}) noise intensity levels generated by shore-based heavy construction equipment, expressed as dBA measured at a distance of 50 ft or 10 meters (33 ft; USDOT 2006; DEFRA 2005).

Table 45. Typical Air-Transmitted Noise Levels of Land Construction Equipment

Equipment	Averaged measured L_{max} @ 50 ft (dBA)[a]	Measured L_{eq} @ 33 ft (dBA)[b]
Bulldozer	82	81-86
Dump Truck	76	79-87
Excavator	81	69-89
Front End Loader	79	68-82

a. USDOT 2006; b. DEFRA 2005.

Studies of the frequency ranges of construction machinery noise tend to measure sound pressure levels in a general range of 0.063 to 8 kHz (Roberts 2009; DEFRA 2005), but this may again represent an emphasis on human hearing, and not the full range of frequencies generated by the equipment.

Air-transmitted noise levels generated by tugboat diesel engines are comparable to those of large construction equipment, generally 70-100 dBA within 50 ft of the engine (Navy 1987; USACE 2011; Dyer & Lundgard 1983).

The transmission of land-generated air-transmitted noise into an adjacent waterbody is not well studied. The transfer of sound energy from air into water via sound waves striking the air/water interface at a shallow angle is generally understood to be poor (Zhang 2002); noise generated on land at an elevation not far above the surface of an adjacent water body would be to a significant degree reflected off of the water's surface and not transmitted into the water.

Sound energy can also be transmitted from ground-based sources into water via vibration. Vibration from non-impact construction machinery transmitted through the ground is typically very low frequency, in the 10-30 Hz (0.01-0.03 kHz) range (Roberts 2009).

Pile Driving Noise: The type and size of pile driving equipment can affect the underwater sound generated during pile driving events. Impact pile driving is the most commonly used pile driving method; the amplitude and characteristics of underwater noise generated by impact driving depend on the energy of the hammer strike, as well as the size and composition of the pile. Underwater noise from impact pile driving is always "impulsive" (CALTRANS 2015).

Vibratory pile drivers use oscillatory hammers that vibrate the pile, causing the sediment surrounding the pile to liquefy and allow pile penetration. Peak sound pressure levels for vibratory hammers can exceed 180 dB; however, the sound from these hammers rises relatively slowly. The vibratory hammer produces sound energy that is spread out over time (i.e., is non-impulsive) and is generally 10 to 20 dB lower than impact pile driving (CALTRANS 2015).

While the specific type and manner of pile driving to be used during construction of the proposed project has not been established, the draft BA provides preliminary evaluations of the potential underwater noise that may be generated. The Alaska District does not have source level sound data for pile-driving in the waters around Nome. A literature review was conducted to find appropriate surrogate data and extrapolate those data for the subject analysis; this extrapolation uses some existing data and requires some assumptions regarding the source level that would be produced by the proposed pile driving and the attenuation rate of the underwater noise. The State of California (CALTRANS 2015) describes hydroacoustic data from several projects involving the use of an impact hammer to drive 36-inch-diameter hollow steel piles. The typical received impulsive sound pressure levels (SPLs) for driving such piles in water less than 5 meters deep are:

- 208 dB peak;
- 190 dB root-mean-square (RMS);
- 180 dB sound exposure level (SEL).

The draft BA estimates that the Level A injury and Level B harassment thresholds would extend the following distances from the impact noise source by hearing group as shown in Table 46:

Table 46. Impulsive Noise Threshold Distances (estimated) for Driving 36-In Piles

Hearing Group (Table 44)	Level A (injury) Threshold Distance (m)	Level B (harassment) Threshold Distance (m)
Phocid pinnipeds	22.5	1,000
Otariid pinnipeds	1.4	1,000
Mid-frequency cetaceans	22.5	1,000
Low-frequency cetaceans	29.3	1,000

Per the draft BA, vibratory pile driving is not expected to generate injurious levels of sound energy for any hearing group. However, the draft BA estimates the distance threshold for harassment levels (120 dB) from vibratory pile driving at 7,356 meters. The USACE expects that the sheet pile docks would be constructed after the new rubble mound structures are in place and that the rock structures would greatly attenuate the underwater noise generated from the vibratory driving of the sheet pile. Nonetheless, the area and distances at which 120 dB or greater underwater sound energy levels are possible are very large (Figure 80), larger than can be effectively monitored during construction.

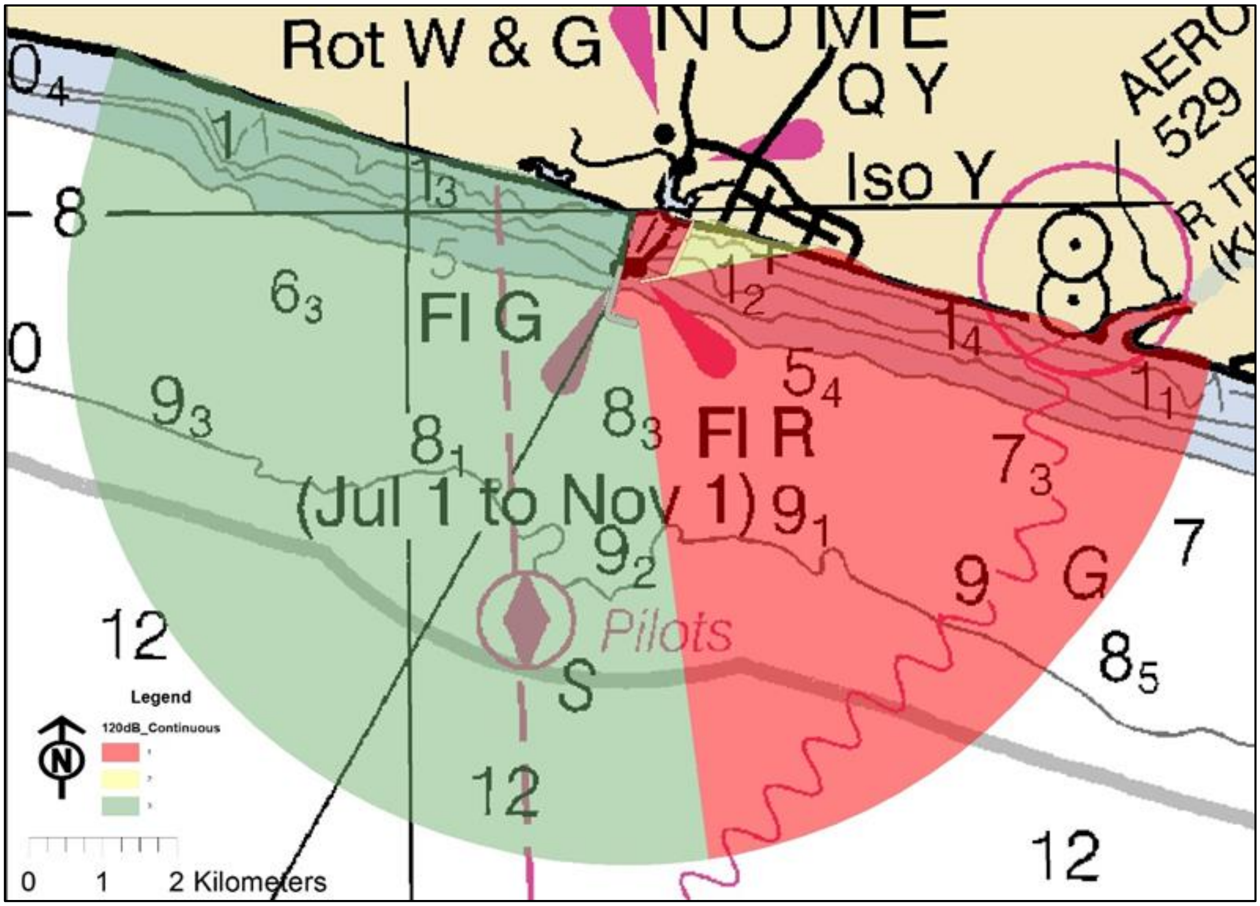

Figure 80. The 120dB harassment threshold distance from vibratory pile driving; the area shielded by rock structures is shown in green, and the unshielded area is shown in red.

The USACE intends to prepare an application for an Incidental Harassment Authorization (IHA) during the design phase of the project and collect specific observation data regarding the abundance and distribution of ESA-listed species in order to determine the potential exposures of protected species to anthropogenic marine noise. Without the direct observation data required for the IHA, the quantification of takes under the definition of harassment is not possible.

Vessel Strikes**:** Project vessel activity during and in support of construction would likely consist of tugs, barges, and scows maneuvering around the immediate project area, transporting rock to project site from the quarry (presumably, the Cape Nome quarry), and transporting project equipment and supplies to Nome from a base port (presumably, Anchorage). The effects of proposed project vessels would be an incremental increase over the effects of very similar vessels that work out of Nome or travel between communities on the Gulf of Alaska and the Bering Sea every year. The probability of strike events depends on the frequency, speed, and route of the marine vessels, as well as the distribution of marine mammals in the area. An analysis of ship strikes in Alaskan waters (Neilson et al. 2012) found that whale mortalities are more likely when large vessels travel at speeds greater than 12 knots. Another study (Vanderlaan and Taggart 2007) used observations to develop a model of the probability of lethal injury based upon vessel speed, projecting that the chance of lethal injury to a whale struck by a vessel is approximately 80 % at vessel speeds over 15 knots, but approximately 20 % at 8.6 knots. The relatively low speed of a typical ocean-going barge and tug (typically no more than 9 knots), together with a barge's blunt prow and shallow draft, make it far less likely to strike and inflict injury upon a marine mammal than larger, faster ocean-going vessels such as cruise ships and cargo ships. The limited maneuverability and long stopping-distance of a barge and tug would make it difficult for the vessels to avoid an observed marine mammal, and in many circumstances, unsafe for them to attempt to do so. Conversely, however, the vessels' low speed and consistent course would enable marine mammals to avoid the path of the barge and tug well before there was a danger of collision.

Project-related vessels en-route between Anchorage and Nome would pass through the critical habitat areas described above for North Pacific right whales and Cook Inlet beluga whales. They would also pass through the 20-nm nautical zone of numerous Steller sea lion rookeries and haul outs in the Gulf of Alaska, and through the Shelikof and Bogoslof Foraging Areas, but would not approach within 3 nm of any rookeries or haul outs.

<u>Release of Contaminants:</u> The increased vessel activity during project construction represents an increased risk of accidental leaks and improper discharges of fuel or other pollutants. Such releases may come from tugboats and survey vessels. Onshore discharges from land construction equipment could potentially also contaminate marine waters. Dredging of contaminated sediment in the inner harbor also has the potential to remobilize and spread pollutants.

Long-Term Effects of the Completed Project

The intent of the completed project is to relieve congestion in the Port of Nome, allow larger vessels to dock at Nome, and improve emergency response for marine spills and vessels in distress. The observed and anticipated increase in shipping through the Bering Strait has been a cause of considerable environmental concern in the region (Kawerak 2016). The proposed project, is in part, a response to the increasing Bering Strait shipping traffic, and the risks and opportunities it represents. An expanded Port of Nome is not expected, in of itself, to create a significant further increase in shipping traffic from the Arctic Ocean. The ability to berth larger ships is likely to attract only a handful of additional large ships through the Bering Strait each year, primarily cruise ships and vessels in distress. An expanded Port of Nome is more likely to change the size and number of vessels traveling between Nome and other Alaskan ports, using established sea lanes. Larger vessels at Nome pose a risk of larger fuel spills and improper discharges; on the other hand, larger vessels may mean fewer vessel transits to deliver the same amount of goods. A specific aim of the port modification is to allow fuel tankers to moor while transferring fuel and reduce the current risky practice of off-shore fuel transfers. A reduction in vessel congestion within the harbor during the busy ice-free season, and the improved and more orderly moorage that the project would allow, should reduce the risk of spills and improve enforcement of discharge regulations.

Another potential long-term effect of the finished project may be to provide a base for larger fishing and processing vessels. Such vessels would be able to exploit the changing Bering Sea and Arctic Ocean fisheries in new ways and may have a negative and unpredictable impact on marine mammal prey species.

It is possible that the extended causeway and altered breakwater may have a small, localized effect on the formation of shore-fast ice at Nome, and therefore on the local winter distribution of seals and other ice-dependent species.

USFWS Species

Polar bears. The great majority of project construction or study activities would occur when ice is absent from the Port of Nome area, and therefore when a polar bear is least likely to be present near Nome. Geotechnical studies needed prior to the start of construction might be conducted in late winter from sea ice beyond the existing causeway. Rock quarrying in support of the project could occur in winter at the Cape Nome quarry site. This established quarry is relatively close to the designated barrier island CH fronting Safety Sound (
Figure 34), but outside of the 1-mile no-disturbance zone associated with that CH. A polar bear that found itself near Nome after sea ice has retreated in the spring would be in far more immediate danger from vehicles, hunters, and public safety officers than from construction of the proposed project.

Steller's and spectacled eiders. Potential impacts on Steller's eiders would be limited to disturbance of migrating birds that may pass close to Nome while construction is underway. Eiders attempting to settle and rest in nearby wetlands or nearshore waters might be displaced by construction noise and movement, but large areas of similar, disturbance-free habitat is readily available near the project site.

Northern Sea Otter and Short-Tailed Albatross. The USACE determines that project activities would have no effect on these species, as they would not be present in the Norton Sound ROI, and project vessels in transit are very unlikely to encounter or affect them.

Comparison of Alternatives. Injurious noise from pile-driving is the greatest potential adverse effect on ESA-listed marine mammals. The six structural alternatives would have similar effects on ESA-listed species, differing primarily in the duration of the effects, rather than the intensity or nature of the effects.

Mitigatory Measures:

1. Noise and disturbance.

During all pile-driving, dredging, and other in-water work:

- A qualified marine mammal observer(s) would be present. All observers must be able to spot and identify marine mammals and record applicable data during all types of weather during all in-water activity.

- Marine mammal observers would have no other duties during the observation period, in order to ensure that watching for protected species remains the observer's main focus.

- Marine mammal observers would have the authority to stop pile-driving operations immediately, and/or lower noise levels to less than 120 dB when marine mammals are visible within the exclusion zones. Estimated exclusion zones are developed in the draft BA (Appendix J) and discussed above; the extent of exclusion zones would be refined during formal ESA consultation with the NMFS.

- For dredging, rock-placement, and other in-water activities in which harassment is possible (but not injurious noise), the exclusion zone would be 75 meters.

- Marine mammal observers would watch for marine mammals within the exclusion zone for 30 minutes prior to pile-driving. If a marine mammal is observed within the exclusion zone during the 30 minute observation period prior to start-up, the observation period need not start over once the animal moves out of the exclusion zone, but work may not commence until the animal is outside the zone.

- Marine mammal observers would have the authority to (1) immediately stop pile-driving activities when a marine mammal is present within or is approaching the exclusion zone, and (2) provide clearance for work to resume after the animal leaves.

- A lead observer should be responsible for implementing the protocols. The lead observer may select and train additional observers but should remain accountable for their performance.

- An observation station(s) would be established to maximize the visibility of the exclusion zone. The observer shall order all pile driving activity to cease whenever the exclusion zone is not fully visible due to weather or low light. Activities would not commence until viewing conditions make it possible to observe the entire exclusion zone.

- Pile driving or any work with the potential to generate noise levels above 120 dB (impact and/or vibratory hammers) shall start at low intensity to allow for marine mammals to evacuate the exclusion zone.

- The existing Outer Basin is known to be a congregating area for some marine mammals, including bearded seals, particularly in the fall. To the extent practical, construction activities that generate an unusual degree of disturbance (i.e., pile-driving) would be avoided during September and later in the construction season.

2. Vessel Strikes. The NMFS has recommended the following general measures to minimize the risk and harm to protected marine species (ESA and MMPA) from vessel strikes; these would be followed to the extent practicable:

- Proposed action-related vessels would be limited to a speed of 8 knots or the slowest speed above 8 knots consistent with safe navigation to reduce the risk of collisions with protected species:
  - when within 3 nautical miles of any Steller sea lion haul outs or rookeries;
  - when transiting the North Pacific right whale CH areas; and
  - when transiting the Cook Inlet beluga whale CH areas.
- Vessel operators would strive not to approach within 100 yards of a marine mammal to the extent practicable, given navigational and safety constraints.
- The contractor performing the work would prepare an Oil Spill Prevention and Control Plan describing steps to avoid and mitigate releases of hazardous substances.

a. Cook Inlet Beluga Whales: The NMFS has recommended special conservation measures to minimize the impacts of vessel strikes on Cook Inlet beluga whales within their designated CH. Vessels should exercise special caution in the vicinity of the Susitna Delta to minimize the impacts of vessels within this seasonally vital Cook Inlet beluga whale habitat. The Susitna Delta Exclusion Zone (Figure 81) is defined as the union of the areas defined by:

- a 10-mile (16 km) buffer of the Beluga River thalweg seaward of the mean lower low water (MLLW) line,
- a 10-mile (16 km) buffer of the Little Susitna River thalweg seaward of the MLLW line, and,
- a 10-mile (16 km) seaward buffer of the MLLW line between the Beluga River and Little Susitna River.
- The buffer extends landward along the thalweg buffers to include intertidal area up to mean higher high water (MHHW). The seaward boundary has been simplified so that it is defined by lines connecting readily discernible landmarks.

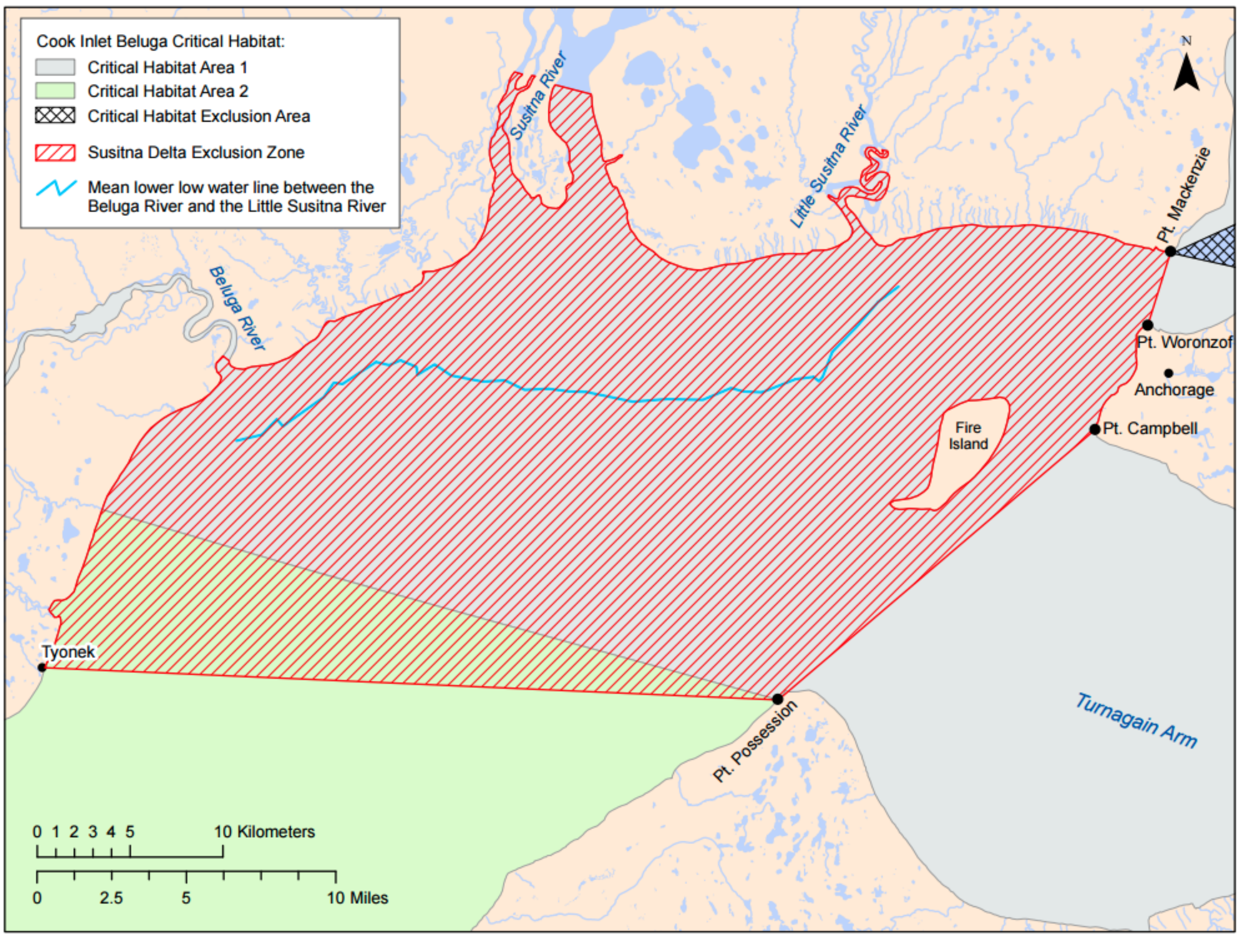

Figure 81. Boundaries of the Susitna Delta Exclusion Zone

For vessels operating in the Susitna Delta Exclusion Zone, the following should be implemented:

- All vessels operating within the designated Susitna Delta area should maintain a speed below 4 knots. Crews must note the numbers, date, time, coordinates, and proximity to vessels of any belugas observed during operations, and report these observations to NMFS.
- Protected species observers (PSOs) must be in place to monitor for ESA-listed species prior to and during all vessel movements when vessels are under power (propellers spinning) within the Susitna Delta Exclusion Zone. PSOs are not required to be observing when vessels are not under power (in gear).
- PSOs must be located in a position that affords a view of all waters within a 100-meter radius of all vessels under power (in gear).
- Exercise special caution in the vicinity of the Susitna Delta to minimize the impacts of vessels within this seasonally vital Cook Inlet beluga whale habitat.
- Vessel operators must avoid moving their vessels when PSOs are unable to adequately observe the 100-meter zone around vessels under power (in gear) due to darkness, fog, or other conditions, unless necessary for ensuring human safety.
- If any vessels enter the Susitna Delta Exclusion Zone at any time, PSOs must record and email to NMFS: date, time, number, and geographic coordinates of ESA listed marine mammals observed during vessel movements and descriptions of any deferred vessel movements or vessel re-directions.

b. North Pacific Right Whale: The vessel operator should avoid transits within designated North Pacific right whale CH (see Figure 32). If transit with North Pacific right whale CH cannot be avoided, NMFS recommends a route along the western boundary of the CH where historical and contemporary observations indicate that North Pacific right whales are not as concentrated as other areas in the CH. In addition, if transit with North Pacific right whale CH cannot be avoided, NMFS recommends that transit in right whale CH be limited to between September and March, a time of year right whales may be at lower numbers in the Bering Sea.

If transiting in North Pacific right whale CH, vessel operators are requested to exercise extreme caution and observe the 10-knot (18.52 km/h) vessel speed restriction. Operators transiting through North Pacific right whale CH should have trained Protected Species Observers (PSOs) actively engaged in sighting marine mammals. PSOs would increase vigilance and allow for reasonable and practicable actions to avoid collisions with North Pacific right whales. Operators would maneuver vessels to keep 800 meters away from any observed North Pacific right whales while within their designated CH and avoid approaching whales head-on consistent with vessel safety. Vessels should take reasonable steps to alert other vessels in the vicinity of whale(s), and report of any dead or injured listed whales or pinnipeds.

3. Release of Contaminants. The contractor would be required to prepare an Oil Spill Prevention and Control Plan. Reasonable precautions and controls would be used to prevent incidental and accidental discharge of petroleum products or other hazardous substances. Fuel storage and handling activities for equipment would be sited and conducted, so there is no petroleum contamination of the ground, surface runoff, or water bodies. Equipment would be inspected on a daily basis for leaks. If leaks are found, the equipment would not be used and pulled from service until the leak is repaired. During construction, spill response equipment and supplies such as sorbent pads shall be available and used immediately to contain and clean up oil, fuel, hydraulic fluid, antifreeze, or other pollutant spills. Any spill amount must be reported in accordance with Discharge Notification and Reporting Requirements (AS 46.03.755 and 18 AAC 75 Article 3).

4. Polar Bear Interaction Plan. In the unlikely event that a polar bear is encountered by project personnel, they would follow the standard Polar Bear Interaction Guidelines distributed by the USFWS.

Magnitude of Effects: Moderate. The proposed actions may have effects that are sufficient to alter noticeably but not to destabilize important attributes of the resource. Construction activities such as pile driving, dredging, and vessel operations may have adverse effects on some ESA-listed species. These effects would be limited in duration to the construction period, and limited in extent to, at most, within a few kilometers of the construction area. The draft BA (Appendix J) finds that project construction is “likely to adversely affect” the following species, due to exposure to underwater noise from dredging and pile driving (limited to Level B harassment):

- Ringed seals (Arctic DPS)
- Bearded seals (Beringia DPS)
- Steller sea lions (Western DPS)
- Gray whales (Western North Pacific DPS)
- Humpback whales (Western North Pacific and Mexico DPSs)

The USACE determines that the project activities would have “no effect” on the following species, due to the very low probability of these species being in the project area, or of being encountered by a project vessel in transit:

- Sperm whale

- North Pacific right whale
- Bowhead whale
- Fin whale
- Blue whale
- Beluga whale (Cook Inlet DPS)

The USFWS concurred in a letter dated 12 March 2019 (USFWS 2019) with the USACE's determinations of "may affect, but not likely to adversely affect" for:

- Polar bears
- Steller's eiders
- Spectacled eiders

The USACE determines that the project activities would have "no effect" on the following species, due to the very low probability of these species being in the project area, or of being encountered by a project vessel in transit:

- Short-tailed albatross
- Northern sea otter (Southwest Alaska DPS)

The USACE determines that no Critical Habitat for any species would be adversely affected by the project activities.

Table 47 summarizes the relevant ESA species, the mitigatory measures (as discussed above) that apply to each species, the USACE effects determination made for that species, and the status of agency concurrence with that determination.

Table 47. Summary of ESA Species, Mitigatory Measures, and Determinations.

Species	Listed Population	Applicable Mitigatory Measures	USACE ESA Determination	Agency Jurisdiction	Agency Concurrence Status
Ringed seal	Arctic DPS	a, b, c	May affect, likely to adversely affect	NMFS	Proceeding to formal consultation
Bearded seal	Beringia DPS	a, b, c	May affect, likely to adversely affect	NMFS	Proceeding to formal consultation
Steller sea lion	Western DPS	a, b, c, d	May affect, likely to adversely affect	NMFS	Proceeding to formal consultation
Gray whale	W. North Pacific DPS	a, b, c	May affect, likely to adversely affect	NMFS	Proceeding to formal consultation
Humpback whale	W. Pacific DPS Mexico DPS	a, b, c	May affect, likely to adversely affect	NMFS	Proceeding to formal consultation
Bowhead whale	All	na	No effect	NMFS	na
North Pacific right whale	All	d	No effect	NMFS	na
Sperm whale	All	na	No effect	NMFS	na
Fin whale	All	na	No effect	NMFS	na
Blue whale	All	na	No effect	NMFS	na
Beluga whale	Cook Inlet DPS	d	No effect	NMFS	na
Polar bear	All	c, e	May affect, but not likely to adversely affect	USFWS	Received
Spectacled eider	All	b, c	May affect, but not likely to adversely affect	USFWS	Received
Steller's eider	All	b, c	May affect, but not likely to adversely affect	USFWS	Received
Northern sea otter	SW Alaska DPS	b. c	No effect	USFWS	na
Short-tailed albatross	All	c	No effect	USFWS	na

Mitigatory Measure Key: a. Underwater noise effects avoidance and minimization. b. Vessel-strike avoidance and minimization. c. Contaminant release avoidance and minimization. d. Special vessel restrictions within critical habitat. e. Polar bear interaction plan. NA: not applicable.

8.7.3.2.2 Marine Mammal Protection Act

The potential short and long term effects on MMPA-protected species, in general, would be identical to those just discussed for ESA-listed marine mammals in Section 8.7.3.2.2.

The purpose of the MMPA is to regulate the "taking" of marine mammals. Under the MMPA, "take" means, "to harass, hunt, capture, or kill, or attempt to harass, hunt, capture, or kill any marine mammal," and "harass" means, "any act of pursuit, torment, or annoyance which (a) has the potential to injure a marine mammal or marine mammal stock in the wild; or (b) has the potential to disturb a marine mammal or marine mammal stock in the wild by causing disruption of behavioral patterns, including, but not limited to, migration, breathing, nursing, breeding, feeding, or sheltering" (50 CFR 216.3).

Spotted seals and beluga whales, two non-ESA-listed marine mammals, are known to concentrate around and enter the existing port, especially in the autumn. These species would be at particular risk of a take during late-season construction.

Comparison of Alternatives. Injurious noise from pile-driving and disturbance from general construction activity are the greatest potential adverse effects to marine mammals. The six structural alternatives would have similar effects on marine mammals, differing primarily in the duration of the effects, rather than the intensity or nature of the effects.

Under the No Action Alternative, although potentially positive impacts of the structural alternatives on the environment, such as improved vessel management and fuel-handling, would not be realized.

Mitigatory Measures: The avoidance and minimization measures for underwater noise effects, vessel strikes, and contamination discussed in Section 8.7.3.2.1 would also apply to non-ESA marine mammals.

Magnitude of Effect: Moderate. The mitigatory measures established to avoid adverse effects to ESA-listed species would also serve to avoid takes of marine mammals under the MMPA. Most construction activities would create disturbances that would be only incrementally greater than those generated by the existing seaport. The proposed mitigatory measures would avoid or minimize disruption of marine mammal behavioral patterns to levels that may be detectable, but would not noticeably alter or lead to the alteration of any important attribute of the resource.

Table 48 summarizes the relevant non-ESA species, the mitigatory measures (as discussed above) that apply to each species, the USACE effects determination made for that species, and the status of agency concurrence with that determination.

The USACE has reached out to the USFWS Marine Mammal Office (MMO) to coordinate mitigatory measures for Pacific walrus. The MMO stated that they would accept mitigatory measures developed between the USACE and the NMFS for other pinnipeds as being adequate to protect the Pacific walrus.

Table 48. Summary of impacts on non-ESA Marine Mammals, Mitigatory Measures, and Determinations.

Species	Applicable Mitigatory Measures	Magnitude Determination
Pacific walrus	a, b, c	Potential taking under the MMPA
Spotted seal	a, b, c	Potential taking under the MMPA
Ribbon seal	a, b, c	Potential taking under the MMPA
Harbor porpoise	a, b, c	Potential taking under the MMPA
Killer whale	a, b, c	Potential taking under the MMPA
Beluga whale (other than Cook Inlet DPS)	a, b, c	Potential taking under the MMPA
Stejneger's beaked whale	a, b, c	Potential taking under the MMPA
Sei whale	a, b, c	Potential taking under the MMPA
Minke whale	a, b, c	Potential taking under the MMPA
Gray whale (other than Western North Pacific DPS)	a, b, c	Potential taking under the MMPA

Mitigatory Measure Key:
a. Underwater noise effects avoidance and minimization.
b. Vessel-strike avoidance and minimization.
c. Contaminant release avoidance and minimization.

8.7.3.2.3 Migratory Bird Treaty Act

The proposed activities would directly disturb any birds that use the existing causeway and breakwater as roosting habitat. The disassembly of existing rubblemound structures would remove some roosting habitat but ultimately replace it with more extensive similar habitat. No bird species are known to nest directly on the existing rubblemound. Dredging and other on-water project activities are unlikely to significantly disturb birds already accustomed to the noise and movement of a busy port.

Comparison of Alternatives: Alternatives 3a, 3b, and 3c would involve the least removal of existing rubblemound and therefore cause the least disturbance to roosting birds. Alternatives 4a, 8a, and 8b would cause a greater disturbance through the partial or complete disassembly of the existing breakwater but would create disproportionately greater areas of new roosting habitat.

Under the No Action Alternative, the impacts of the construction alternatives would be avoided; however, the risk of fuel spills other ecological disturbances around the port would likely increase over time as the port becomes busier and more crowded. Potential benefits to seabirds from the construction alternatives, such as improved fuel-handling and vessel management at the port, would not be realized under the No Action Alternative.

In the context of the proposed action, a violation would include any killing of a migratory bird or destruction of an active nest, whether intentional or incidental. A Department of Interior legal opinion issued in December 2017 proposed to limit MBTA violations to intentional takings, but that policy has not yet been implemented.

Migratory Measures: None proposed.

Magnitude of Effects: Minor. The proposed action is unlikely to result in the killing of a migratory bird, or destruction of an active nest.

8.7.3.3 Essential Fish Habitat and Anadromous Streams

The major in-water construction activities would consist of (1) dredging of the seafloor, (2) placement or disposal of construction dredged material, (3) replacement of existing benthic habitat with rock structures, and (4) underwater noise generated from pile driving.

Dredging activities can adversely affect benthic, and water column habitats; the potential environmental effects of dredging on managed species and their habitats include:

- the direct removal and/or burial of organisms;
- increased turbidity and siltation, including light attenuation from turbidity;
- contaminant release and uptake, including nutrients, metals, and organics;
- the release of oxygen-consuming substances (e.g., chemicals and bacteria);
- entrainment;
- noise disturbances; and
- alterations to hydrodynamic regimes and physical habitat (Limpinsel et al. 2017)

Many managed species (such as the flatfish species that make up much of the groundfish listed in Table 9) forage on infaunal and bottom-dwelling organisms. Dredging may adversely affect these prey species by directly removing or burying them. Although macrobenthic communities may recover total abundance and biomass within a few months or years, their taxonomic composition and species diversity may remain different from pre-dredging for more than three to five years. Recovery of microbenthic communities in colder, high latitude environments may require even more time.

Dredging can elevate levels of suspended sediment and organic matter in the water column. The associated turbidity plumes of suspended particulates may reduce light penetration and lower the rate of photosynthesis for subaquatic vegetation. Fish may sustain gill injury and suffer reduced feeding ability if exposed to high suspended sediment levels for extended periods of time. Dredging can also re-suspend and release nutrients and toxic substances that may then become more biologically available to aquatic organisms, or cause short-term oxygen depletion.

Depending upon the equipment used, dredges have the potential to entrain fishes and invertebrates during all life cycle phases, including adults, juveniles, larvae, and eggs. Entrainment is the direct uptake of aquatic organisms caused by the suction field generated by hydraulic dredges. Benthic infauna is particularly vulnerable to entrainment by dredging, although some mobile epibenthic and demersal species, such as shrimp, crabs, and fish, can be susceptible to entrainment as well. Salmonids are frequently cited in studies of fish entrainment.

The noise generated by pumps, cranes and the mechanical action of the dredge has the ability to alter the behavior of fish and other aquatic organisms. The noise levels and frequencies produced from dredging depend on the type of dredging equipment being used, the depth and thermal variations in the surrounding water, and the topography and composition of the surrounding seafloor. It has been hypothesized that dredging-induced sound may block or delay the migration of anadromous fishes, interrupt or impair communication, or impact foraging behavior, and dredging is known to elicit an avoidance response by marine fishes. However, very little is known about the effects of anthropogenic sounds on fish.

Dredging also has the potential for modifying current patterns and water circulation via alterations to substrate morphology. These alterations can cause changes in the direction or velocity of water flow, water circulation, or dimensions of the waterbody traditionally used by fish for food, shelter, or reproductive purposes (Limpinsel et al. 2017, Kelly and Ames 2018).

At the Port of Nome, the direct impacts on fish habitat from the proposed construction dredging would be somewhat lessened by the fact that much of the construction dredging would be the deepening of previously dredged navigation channels and basins, i.e., areas that have been impacted and modified in the recent past. An exception is the Deep Water Basin to be dredged at the end of the extended causeway, which would remove roughly 55 acres of seafloor habitat that has not been previously impacted by harbor operations. Most of the proposed construction dredging would occur at depths of -45 ft below MLLW or less; the substrate within this depth contour is subject to natural disruption from storm surge and ice gouging, and regularly experiences high levels of suspended sediment from wind and wave action (RJW 2013, Kelly and Ames 2018). The operation of hydraulic and mechanical dredges during construction would introduce more sources of underwater noise in the project area than is experienced in a typical working season. Dredging to deepen the inner harbor has the potential to redistribute sediment with elevated levels of arsenic (believed to be the result of naturally-occurring minerals deposited and concentrated within the harbor by the Snake River) and anthropogenic contaminants. The hydrodynamics of the Port of Nome are dominated by the existing causeway and breakwater, and the incremental deepening of the seafloor within those structures is unlikely to significantly alter water circulation or flow.

Dredged material placement can have disruptive effects similar to that of dredging, particularly through altering existing habitat by changing water depth or substrate, smothering benthic organisms, increasing turbidity, and releasing contaminants (Limpinsel et al. 2017). For the Port of Nome project, the current plan is to place the construction dredged material for beach nourishment along the base of the Nome seawall within the depth contour (15 to 30 ft below MLLW) that ensures that the material would be distributed along the shoreline by littoral transport. The zone between this depth contour and the shoreline is regularly disrupted by wave action and ice-grounding, experiences high turbidity levels, and is generally regarded as unable to support a significant benthic community. Placement of the dredged material in this zone is thought to be the least environmentally damaging option for handling the construction of dredged material. The project dredged material would be placed for beach nourishment only if it chemically and physically suitable for unrestricted open-water placement. Some of the dredged material would probably need to be placed by bottom-dump scow rather than a hydraulic pipeline; the additional noise and movement caused by tugs and scows may cause fish to leave the area.

Placement of rubblemound structures to extend the existing causeway and modify or replace the existing breakwater have the obvious direct effect of permanently replacing the existing benthic habitat. Rock placed at and beyond the -40 ft depth contour would destroy some relatively productive habitat of marine-growth-encrusted cobbles, i.e., potential juvenile red king crab EFH (Figure 21). Construction would create noise and disruption from the placement of rock into the water, and from the vessels supporting construction. This disruption may cause fish to leave the area, and may particularly impact migrating fish that may be trying to work their way around the causeway or breakwater. New rubblemound structures built in more southerly waters generally recruit a vigorous growth of marine organisms within a couple of years. The potential for colonization of new rocky habitat at Nome is not well understood; however, as most of what long-term colonization does occur must happen well below the intertidal zone.

The USACE conducted underwater video surveys in May 2019 (Figure 22; Section 3.2.1) with the aim of quantifying the areas of cobble/boulder hard-bottom habitat that would be directly affected by project construction. Cursory calculations (Floyd 2019b; Appendix E) show that if Alternative 8b is constructed:

- the new east causeway would not impact hard-bottom habitat;
- the west causeway extension would replace an estimated 6.2 acres of hard-bottom habitat with rubblemound structure; and

- the dredging of the Deep Water Basin would remove up to an estimated 10.8 acres of existing hard-bottom habitat.

Pile driving can generate intense underwater sound pressure waves that may adversely affect EFH. Fish may leave an area for more suitable spawning grounds or may avoid a natural migration path because of noise disturbances, and can be injured and killed by more intense pressure waves. Short-term exposure to peak sound pressure levels (SPLs) above 180 to 190 dB is believed to cause physical harm to fish, while SPLs around 155 dB may be sufficient to stun small fish (Limpinsel et al. 2017). Adverse behavioral effects are expected above a root mean square (RMS) value of 150 dB (CALTRANS 2015).

The type and intensity of the sounds produced during pile driving depend on a variety of factors, including the type and size of the pile, the firmness of the substrate into which the pile is being driven, the depth of water, and the type and size of the pile-driving hammer:

- Sound pressure levels are positively correlated with the size of the pile, as more energy is required to drive larger piles.
- Firmer substrates require more energy to drive piles and produce more intense sound pressures.
- Sound attenuates more rapidly with distance from the source in shallow water than it does in deep water.
- Studies have shown that fish display an avoidance response to the sound from vibratory hammers, and do not habituate to such sound, whereas fish may become habituated to impact hammer sounds after an initial startle response, and may remain within range of potentially harmful sound (Limpinsel et al. 2017).

As is described in Section 8.7.3.2.1, the sheet pile and mooring-dolphins would be installed after the rubble mound structures are in place, which would greatly reduce the area affected by underwater noise from pile driving.

The EFH Assessment (Appendix E) was prepared before the full scope of pile driving necessary for the proposed project became apparent. The EFH Assessment discusses underwater noise, but proposed no mitigatory measures. In renewed EFH consultation with the NMFS, the USACE proposed incorporating generic underwater noise mitigation measures promoted by the NMFS (Limpinsel et al 2017), in lieu of preparing a new EFH Assessment. The NMFS agreed with this arrangement in an email dated 25 November 2019 (Kelly 2019).

After construction, the expanded port facilities may result in continuing direct and indirect impacts to EFH, including increased maintenance dredging, and an increase in the size and number of vessels using the port. The intent of the completed project is to relieve congestion in the Port of Nome, allow larger vessels to dock at Nome, and improve emergency response for marine spills and vessels in distress. The observed and anticipated increase in shipping through the Bering Strait has been a cause of considerable environmental concern in the region (Kawerak 2016). The proposed project is, in part, a response to the increasing Bering Strait shipping traffic, and the risks and opportunities it represents. In of itself, an expanded Port of Nome is not expected to create a significant further increase in shipping traffic from the Arctic Ocean; the ability to berth larger ships is likely to attract only a handful of additional large ships through the Bering Strait each year, primarily cruise ships and vessels in distress. An expanded Port of Nome is more likely to change the size and number of vessels traveling between Nome and other Alaskan ports, using established sea lanes. Larger vessels at Nome pose a risk of larger fuel spills and improper discharges; on the other hand, larger vessels may mean fewer vessel transits to deliver the same amount of goods. A specific aim of the port modification is to allow fuel tankers to moor while transferring fuel and reduce the current risky practice of off-shore fuel transfers. A reduction in vessel congestion within the harbor during the busy ice-free season, and the improved and more orderly moorage that the project would allow, should reduce the risk of spills and improve enforcement of discharge regulations.

Another potential and indirect long-term effect of the finished project may be to provide a base for larger fishing and processing vessels. Such vessels would be able to exploit the changing Bering Sea and Arctic Ocean fisheries in new ways and may have a negative and unpredictable impact in EFH.

Marine invasive species may become a threat to EFH in the Bering Strait region, as climatic and oceanographic changes become more apparent. Larger ships arriving from northern Asian and European ports may transport new species able to survive in the Nome area, via bilge water and hull biofouling CAFF and PAME 2017). Iceland, at much the same latitude as the Seward Peninsula, has seen an influx of numerous invasive tunicates, crustaceans, and fish from the eastern Atlantic coast (Fernandez et al. 2014). Alaskan waters have seen few marine invasive species so far, although a potentially harmful tunicate species has been found near Sitka, and several other potential invasive species, such as the Chinese mitten crab and the European green crab, are under surveillance (ADFG 2019c, ADFG 2002).

Extensions of the causeway or breakwater should not adversely affect salmon migrations as long as the fish passage breaches in those structures are kept open. An extended causeway may provide an earlier and more effective anchor for shore-fast ice, which may result in a more stable platform for winter subsistence ice-fishing, especially for red king crab. Small fishes such as smelt and saffron cod would find the earlier formation of ice a refuge from marine mammals and birds (Lean 2019).

Comparison of Alternatives: The six structural alternatives would affect the same environment in roughly the same ways, and would have similar impacts on EFH. The alternatives that extend the causeway farther out into waters 40-45 ft deep (alternatives 8a and 8b) would impact more of the marine-growth-encrusted cobble habitat known to exist near the port. The longer causeway alternatives would also presumably have a greater influence on the formation of shore-fast ice. For all structural alternatives, the duration of annual maintenance dredging would increase significantly relative to the current annual dredging, and underwater sound from dredging may increase if more powerful dredging pumps are required for the expanded annual dredging.

Under the No Action Alternative, annual maintenance dredging would continue in an area of up to 35 acres. While the impacts of the construction alternatives would be avoided, the risk of fuel spills other ecological disturbances around the port would likely increase over time as the port becomes busier and more crowded. Potential benefits to EFH from the construction alternatives, such as improved fuel-handling and vessel management at the port, would not be realized under the No Action Alternative.

Mitigatory Measures:

1. The timing of the proposed construction activities would be coordinated with the Alaska Department of Fish and Game. The current ADFG fish habitat permit (FHP) for the annual maintenance dredging at Nome (FH13-III-0027, Amendment #3, expiring 31 December 2022) states that:

- Within the [inner] harbor and entrance channel dredging would commence annually from as soon as practicable after the ice goes out through June 30.
- Within the breakwater [i.e., between the causeway and breakwater] there is no closed period for dredging.
- Dredging within and at the mouth of the entrance shall be conducted in a manner that would either allow for continuous free passage of fish or dredging [shall be conducted] for only a 12-hour period per 24-hours.

A separate FHP for the proposed construction activities is not expected to be required (Note: the EFH Assessment states that a separate FHP might be required, but that was written when activities within the Inner Harbor were still part of this project scope). Since then, the inner harbor has been removed from this project.

2. To the extent practicable, the existing fish passages in the causeway and breakwater would be kept passable through the removal of accumulated sediment

as necessary. This would be of particular importance when the active construction of new rubblemound structures may impair the movement of fish around the causeway and breakwater. For alternatives that include replacement of the existing east breakwater with a new causeway, that new structure would also have a suitable fish passage breach, and nearshore construction would be timed to minimize impacts on migrating fish.

3. The NMFS recommends (NMFS 2019) that the USACE "pursue the beneficial ocean placement of appropriate coarse grain dredge spoils… (e.g., cobble and boulders) excavated during the project to mitigate the loss of EFH through the creation of habitat in deeper waters offshore that do not currently support living substrates or the critical life stages for species such as crab." The NMFS has not advocated a specific quantitative goal for replacing lost hard-bottom habitat; the concept is to beneficially relocate and reuse, to the extent practicable, cobbles and boulders that are recovered from the seafloor during project construction dredging.

4. The USACE would conduct a survey of submerged portions of the existing rubblemound causeway and breakwater, to gain information on how new rock structures can be expected to interact with the nearshore environment at Nome; an initial survey of the existing causeway and breakwater was performed in May 2019 (Section 3.2.1). The USACE would also establish long-term monitoring of the new/extended rubblemound structures for recolonization of habitat-forming organisms as well as any abundance information on predator species (e.g., sculpin) that may impact species with designated EFH in the Nome area (e.g., juvenile salmonids, crab), and would provide NMFS with any information on changes in the presence or abundance of any fish or prey of fish over time (NMFS 2019).

5. Rock for new rubblemound construction would be free of contaminants and invasive species. To the extent practicable, rock material removed from the existing rubblemound structures in the course of construction would be reused at the project site.

6. The selected contractor would include an Oil Spill Prevention and Control Plan, and a plan for minimizing the spread of invasive species, in its Environmental Protection Plan, which is submitted to the USACE for review and approval.

7. Prior to the start of construction dredging, representative samples of the material to be dredged would be sampled and analyzed for a broad range of potential contaminants. The material would be tested for total organic carbon, ammonia, and sulfides. An elutriate test appropriate to the anticipated construction dredging conditions would also be performed.

8. To the extent practicable, pile driving activities would follow NMFS recommendations (Limpinsel et al. 2017) to minimize underwater noise impacts on EFH:

Common measures to reduce the underwater sound generated by in-water pile driving include treatments to reduce the transmission of sound through the water and treatments to reduce the sound generated by the pile:

- Install hollow steel piles with an impact hammer at a time of year when larval and juvenile stages of fish species with designated EFH are not present.

If this first measure is not possible, then the following measures regarding pile driving should be incorporated when practicable to minimize adverse effects:

- Drive piles during low tide when they are located in intertidal and shallow subtidal areas.
- Use a vibratory hammer when driving hollow steel piles. When impact hammers are required due to seismic stability or substrate type, drive the pile as deep as possible with a vibratory hammer first and then use the impact hammer to drive the pile to its final position.

Follow standard procedures to measure and analyze the underwater noise from pile driving. Implement measures to attenuate the sound should levels exceed the interim criteria thresholds: when peak SPLs reach 206 dB re 1 µPa during a single strike and/or when the accumulated SEL from multiple strikes reaches 187 dB re 1 µPa for large fishes (≥2 g) or 183 dB re 1 µPa for small fishes (< 2 g). If sound levels are anticipated to exceed these acceptable limits, implement appropriate mitigation measures, when practicable. Methods to reduce the SPLs and SELs include, but are not limited to, the following:

- Surround the pile with an air bubble curtain system or air-filled cofferdam.
- Because the sound produced has a direct relationship to the force used to drive the pile, use a smaller hammer to reduce sound pressure.
- Use a hydraulic hammer if impact driving cannot be avoided. The force of the hammer blow can be controlled with hydraulic hammers; reducing the impact force would reduce the intensity of the resulting sound.
- Drive piles when the current is reduced (i.e., centered around slack current) in areas of strong current to minimize the number of fish exposed to adverse levels of underwater sound.

The USACE would continue to work with the NMFS on refining project-specific conservation recommendations as more detailed information on construction methods and materials is developed.

Magnitude of Effects: Moderate. In its EFH assessment (Appendix H), the USACE has determined that the proposed project would adversely affect EFH, but in minor, localized ways that can be largely offset through conservation measures, and through effective post-construction management and enforcement of spill prevention and response at the expanded port. The NMFS has concurred with this determination (NMFS 2019) and contributed to the conservation measures listed above. The effects on EFH would noticeably alter some highly localized areas of EFH, but would not destabilize any important attribute of the overall resource.

8.7.3.4 Special Aquatic Sites

Special aquatic sites, as defined in Section 3.2.4, are not known to be present in the project area except as small pockets of estuarine wetlands located miles away from the immediate construction area.

Comparison of Alternatives: Neither the structural alternatives nor the No Action Alternative would have an effect on special aquatic sites.

Mitigatory Measures: None proposed.

Magnitude of Effects: Minor. No detectable impacts are expected to special aquatic sites.

8.7.4 Cultural Resources

Per 40 CFR 1508.8, this analysis reviewed the potential effects on aesthetic, historical, and cultural resources both directly and indirectly impacted by the proposed navigation improvements. The proposed navigation improvements at the Port of Nome have the potential to affect the Snake River Sandspit Site (NOM-00146) and the Nome Subsurface Historic District (NOM-00158), both of which may be within the Area of Potential Effect (APE; Figure 82). Such effects would be associated with the relatively small extent of upland construction needed under Alternatives 4a, 8a, and 8b to create a road approach to and construct the new East Causeway.

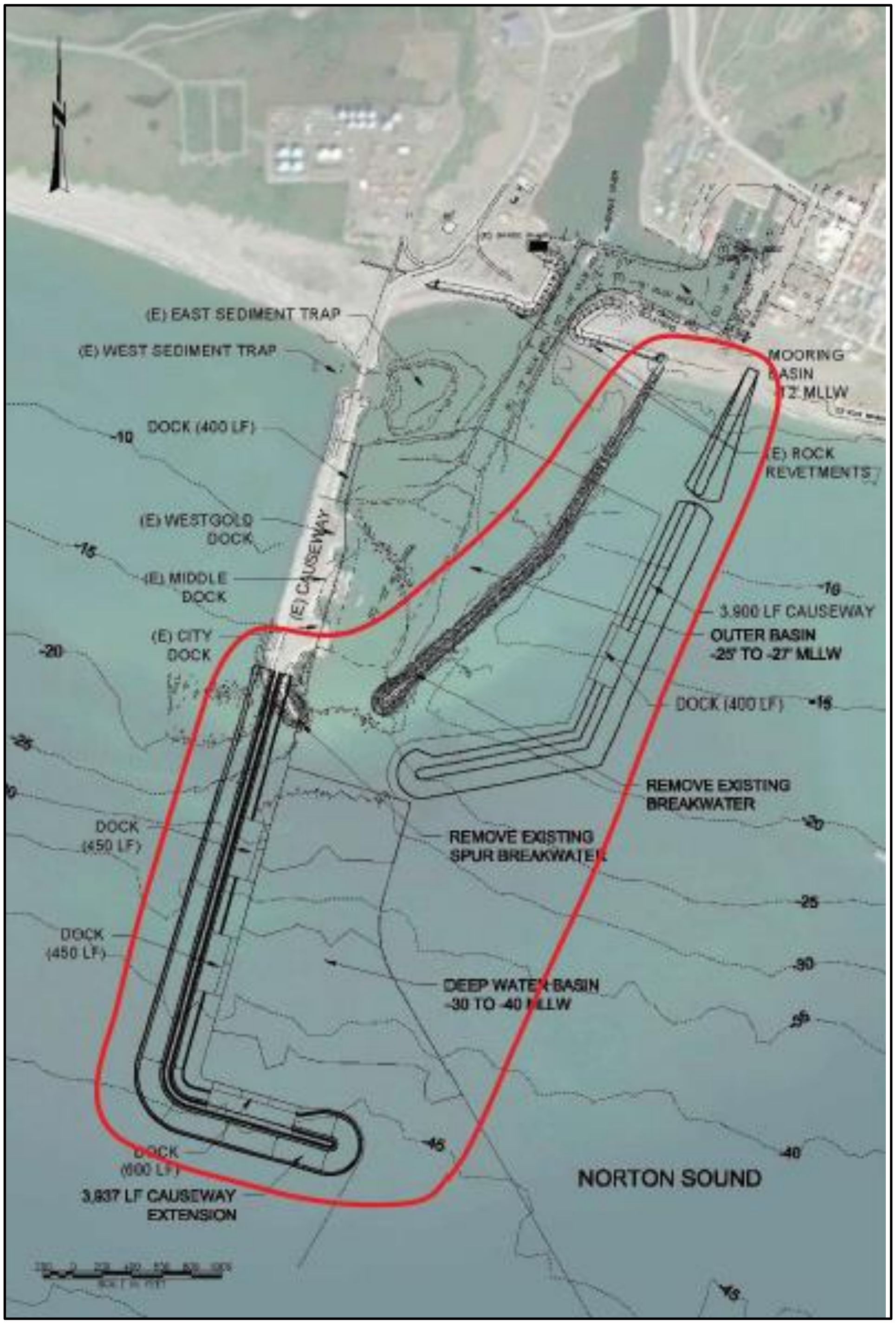

Figure 82. Area of Potential Effect for the proposed navigation improvements (in red).

The Snake River Sandspit Site (NOM-00146) is a subsurface precontact site that was first identified during USACE navigation improvements to the Port of Nome in 2005. Due to its information potential, it was determined to be eligible for the National Register of Historic Places (NRHP) under Criterion D. It is unknown whether this subsurface site actually extends into the proposed undertaking's APE. When the east breakwater was constructed in 2005, no cultural materials associated with the site were identified. Additionally, due to the fact that the known site features (House A, House B, Midden) were deeply buried at approximately 14 ft below ground surface, it is unlikely that any site features that may exist within the APE would be disturbed by the 2-ft deep excavations associated with the Alternatives 4a, 8a, and 8b.

According to the Alaska Historic Resource Survey (AHRS), the Nome Subsurface Historic District (NOM-00158) is a

> "subsurface historic district primarily identifiable as building foundations, boardwalks, refuse middens, and isolated elements of the Euro-American settlement of the city of Nome in the late-19th and early-20th century. The exact boundaries are unknown, but could conceivably cover the entire original 40-acre townsite [east] of the mouth of the Snake River (and beyond) as well as the southern areas of the original 40-acres townsite N of the river. It is located directly on the settlement era ground surface and may extend up to 10" below surface… Throughout Nome, it has been covered by up to 7' of fill, which contains scattered historic artifacts… Additionally, modern items are being incorporated into the horizon as outlying areas are covered with fill" (AHRS 2019).

For the purposes of this undertaking, the USACE proposes to treat NOM-00158 as eligible for the NRHP.

It is unknown whether NOM-00158 actually extends into the proposed undertaking's APE. When the east breakwater was constructed in 2005, no intact historical cultural materials were identified. The proposed site of the East Causeway is also the former location of beach nourishment deposits in 2008 and 2009. The beach nourishment location was moved eastward in 2009 due to the fact that too much accretion was occurring. Therefore, it is highly unlikely that any of the approximate 10-inch layer of historical materials (building foundations, boardwalks, artifacts, etc.) associated with NOM-00158 that may be in the APE would be disturbed by the proposed 2-ft deep excavations associated with the Alternatives 4a, 8a, and 8b.

Comparison of Alternatives. Alternatives 3a, 3b, 3c involve no upland earthwork and have no potential to affect historic properties. Alternatives 4a, 8a, and 8b require a small amount of upland excavation related to the construction of a new eastern causeway; however, the shallow nature of the proposed construction methods would not impact any subsurface cultural resources associated with NOM-00146 or NOM-00158, which may be within the APE.

The No Action Alternative would have no adverse effect on historic properties.

Mitigatory Measures: In order to minimize the proposed action's impacts on any post-review discoveries [36 CFR § 800.13], an archaeological monitor who meets the Secretary of Interior's Professional Qualifications Standards [62 FR 33708] would be present during all terrestrial ground-disturbing activities.

Magnitude of Effects: Minor. The USACE has determined that the proposed action would have no adverse effect on historic properties under Section 106 of the NHPA [36 CFR § 800.5(b)]. The Alaska State Historic Preservation Officer (SHPO) has concurred with a determination of no historic properties adversely affected (see Appendix G [Correspondence]). The proposed action would not alter or lead to the alteration of any important attribute of cultural resources.

8.7.5 Subsistence Use

Section 803 of Alaska National Interest Lands Conservation Act (ANILCA) defines subsistence use as "the customary and traditional uses by rural Alaska residents of wild, renewable resources for direct personal or family consumption of food, shelter, fuel, clothing, tools, or transportation; for the making and selling of handicraft articles out of nonedible byproducts of fish and wildlife resources taken for personal or family consumption; for barter, or sharing for personal or family consumption; and for customary trade." Subsistence activities are of vital importance to the individuals, families, communities, and cultures of the Norton Sound. This section analyzes whether or not the proposed project would impact *access* to subsistence opportunities in the local Nome area. For information on the proposed project's impact on subsistence use in the region (see Section 2.10).

The Alaska Land Use Council wrote that a significant restriction of subsistence uses occurs if "a proposed action… can be expected to result in a substantial reduction in the opportunity to continue subsistence uses of renewable resources" (ALUC 1984). Additionally, the U.S. District Court Decision of Record in *Kunaknana vs. Watt* [No. A83-337 CIV, D. Alaska Dec. 20, 1983] stated that "restrictions for subsistence uses would be significant if there were large reductions in abundance or major redistribution of these resources, substantial interference with harvestable access to active subsistence-use sites, or major increases in non-rural resident hunting." These access concerns include not only the physical access to subsistence areas but potential increases to the cost of their use and potential increases in competition for subsistence resources.

Short-Term Effects

Access through the Port of Nome would need to be maintained for all users during construction, so no short-term direct impacts on physical access to subsistence resources are anticipated. Short term changes in the distribution or abundance of subsistence species in the immediate vicinity of construction activity may affect subsistence use. Most salmon subsistence fishing, however, occurs further up the Snake River or out in Norton Sound beyond the Port to avoid the busy summer harbor (Menard 2018). Fall subsistence hunting for seals and beluga whales could potentially be affected by construction activity if that activity disrupts the fall concentration of those species in and around the Outer Basin. Kawerak, Inc. has requested that fall activities at the Port of Nome be coordinated with their advocates to minimize impacts on the important fall hunting season (Kawerak Inc. 2017).

Long-Term Effects

The construction of the “L” shaped extension of the West Causeway would increase wave height outside of the Port of Nome through wave reflection. Depending on wave conditions, this increased wave height may impact maritime subsistence use to the west of the Port of Nome by reducing the number of days a small subsistence skiff could safely travel westward out of the Port.

The number and frequency of subsistence skiffs traveling westward from the Port of Nome is unknown, as is the percentage of total subsistence take in that area. Marine-accessed subsistence resources located to the west of the Port of potential concern include, but are not limited to: salmon, walrus, harbor seal, beluga, and bird eggs collected on Sledge Island (see Kawerak 2013). There are no data available on the subsistence harvest of birds or eggs for Nome (see Oceana and Kawerak 2014; Naves and Keating 2019). Directional data available for the subsistence salmon fishery suggest that fishing westward of the Port of Nome is not common. In 2012, only 13.24 % of the Nome household permits were fished in rivers west of the Port of Nome and only 12.94 % of the permits were fished in marine waters (Menard et al. 2013). In 2015, 21.97 % of the Nome household permits were fished in rivers west of the Port of Nome and only 13.37 % of the permits were fished in marine waters (Menard et al. 2017).

Indirect Effects

It is not clear if the completed project would indirectly affect the practice of subsistence hunting for seals and beluga whales from the port’s rubblemound structures and/or within the Outer Basin. Draft language to disallow hunting in and around the Port of

Nome, out of safety concerns, was put forth in a December 2018 Port Commission Work Session, but withdrawn after members of the subsistence hunting community voiced objections. The current unwritten protocol is for a hunter to notify the Nome Police Department and the Kawerak, Inc. subsistence coordinator if a marine mammal is sighted within the harbor and the hunter intends to harvest it. In September 2018, a pod of beluga whales was spotted in the Outer Basin, but the harbormaster forbade a hunt because multiple vessels and crews were moored along the causeway (City of Nome 2019). An enlarged Outer Basin might provide more safe conditions for the discharge of firearms; on the other hand, the conversion of the east breakwater into another causeway with moorage may result in increased restrictions on hunting within the Outer Basin.

Local subsistence users' concerns about losing access to subsistence resources tend to be less about direct effects from the proposed project, and more about the trend of greater development at the Port of Nome and the surrounding area (Floyd 2018; Austin Ahmasuk personal communication; Mr. Ahmasuk is the Marine Advocate at Kawerak, Inc.). The proposed project is seen as a large step in plans to further expand port facilities inland and around the Snake River (see Section 8.8.2, "Cumulative Effects"). The Nome Native community holds a strong belief that access to subsistence resources should be available to everyone, regardless of income, and that the Snake River and Nome shoreline represent unique "walking distance" subsistence opportunities for low-income Nome residents. For many Native residents lacking transportation, the Snake River and the Nome shoreline is their only direct access to subsistence resources, the community is concerned that long term development of the port area may eventually displace traditional, free access to the Snake River by pedestrians and small boat owners, and want this access preserved.

Concerns about potential indirect effects on subsistence access identified in discussions with the Native community include (Floyd 2018):

- The finished port project would allow larger vessels to dock; this may bring in larger commercial fishing vessels, which may out-compete small family fishing businesses and subsistence users for limited fish and crab stocks.

- More ship traffic and larger vessels using the port may increase the risk, in frequency and severity, of fuel spills and wastewater releases. Such pollution may contaminate marine mammals and fish moving through the port, making them inedible to future subsistence users. Spills at the port would disproportionately affect poorer subsistence users, which depend on the Snake River and other resources close to Nome.

- More ship traffic and larger vessels using the port may affect marine mammals and their migration movements.
- State game regulations allow non-residents to conduct fly-in hunts from Nome; a large influx of construction workers taking advantage of this regulation can compete with Nome residents for a limited stock of game.

Comparison of Alternatives: With all of the structural alternatives, there is a possibility that, in the short-term, construction activities may temporarily displace subsistence species. This impact is analyzed above in Sections 8.7.3.2, 8.7.3.3, and 8.7.3.4. In the long-term, all of the structural alternatives have a possibility to limit pedestrian access to traditional subsistence locations near and within the Port of Nome, if pedestrian use is restricted due to the presence of large vessels or movement of cargo. All of the structural alternatives also have the potential to limit small skiff access to traditional subsistence resources located to the west of the Port of Nome due to wave reflection and subsequent increased wave height. Additionally, due to the expected increase in short-term visitors associated with large passenger vessels, traditional subsistence locations near and within the Port of Nome may be more congested than they were previously, with more people competing for the same resources. If access to subsistence locations are restricted or congested, the cost of obtaining subsistence resources would increase as users would be required to travel further to access similar hunting and fishing opportunities.

The No Action Alternative would have no effect on subsistence resources.

Mitigatory Measures: USACE would continue to consult with local Alaska Native communities to avoid and minimize the short-term effects of construction on subsistence species and subsistence access, particularly with regards to the timing of construction operations. The impact from long-term effects are difficult to quantify due to the lack of subsistence use data; however, those data available indicate that subsistence areas westward of the Port of Nome are not frequently used. Potential indirect effects on access to traditional subsistence locations are largely a land-use issue between the Native community and local government, and it is beyond the scope of this study to recommend mitigation for such effects.

Magnitude of Effects: Minor. Although the proposed project has the potential to impact access to subsistence resources in the local Nome area, it is not expected to *substantially* interfere with harvestable access to subsistence locations or cause a *major* increase in non-rural resident use of subsistence resources.

8.8 Other Required Analyses

8.8.1 Protected Tribal Resources

The Executive Memorandum on Government-to-Government Relations with Native American Tribal Governments of 1994, the Department of Defense American Indian and Alaska Native Policy of 1998, and the Department of the Army Memorandum on American Indian and Alaska Native Policy of 2012 require that the U.S. Army Corps of Engineers assess the impact that Federal projects may have on protected tribal resources and assure that the rights and concerns of Federally-recognized Tribes are considered during the development of such projects. Protected Tribal Resources are defined by the Department of the Army as those natural resources and properties of traditional or customary religious or cultural importance, either on or off Tribal lands, retained by, or reserved by or for Federally-recognized Tribes through treaties, statutes, judicial decisions or executive orders. The Federal government's trust responsibility, deriving from the Federal Trust Doctrine and other sources, for these Protected Tribal Resources is independent of their association with Tribal lands.

This trust responsibility is discharged in this Report through compliance with multiple statutes affecting Protected Tribal Resources (Table 49) and through ongoing Government-to-Government consultation. In this Report, Protected Tribal Resources are generally understood to include natural resources, cultural resources, and access to subsistence resources; no specific resource(s) have been identified by any Federally-recognized Tribe.

Table 49. Sections that address Protected Tribal Resources

Topic	Report Section	Statute
Natural Resources	Section 3.2, Section 4.4, Section 8.7.3	Migratory Bird Protection Treaty Act of 1918, National Environmental Policy Act of 1970, Marine Mammal Protection Act of 1972, Clean Water Act of 1972, Endangered Species Act of 1973, Magnusson-Stevens Fisheries Conservation and Management Act of 1976
Cultural Resources	Section 3.3, Section 4.5, Section 8.7.4	National Historic Preservation Act of 1966, National Environmental Policy Act of 1970, American Indian Religious Freedom Act of 1978, Abandoned Shipwreck Act of 1988, E.O. 13007 "Indian Sacred Sites"
Subsistence Use	Section 3.4, Section 4.6, Section 8.7.5	Marine Mammal Protection Act of 1972, Endangered Species Act of 1973, Alaska National Interest Lands Conservation Act of 1980
Environmental Justice	Section 8.8.2	Clean Air Act of 1963, National Environmental Policy Act of 1970, E.O. 12898 "Environmental Justice"

8.8.2 Environmental Justice and Protection of Children

Executive Order (E.O.) 12898, "Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations," directs Federal agencies to identify and address any disproportionately high and adverse human health or environmental effects of their actions on low-income, minority, and tribal populations, to the greatest extent practicable and permitted by law. An environmental justice (EJ) analysis typically includes the following elements:

a) Identification of any minority and/or low-income status communities in the project area;
b) Identification of any adverse environmental or human health impacts anticipated from the project; and
c) Determination of whether those impacts would disproportionately affect minority and/or low-income communities.

E.O. 13045, “Protection of Children from Environmental Health Risks and Safety Risks,” directs Federal agencies to identify and address environmental health and safety risks that may disproportionately affect children, to the greatest extent practicable and permitted by law. This analysis typically builds off of the EJ analysis and includes a determination of whether the identified adverse environmental or human health impacts anticipated from the project would disproportionately affect children.

8.8.2.1 Identification of Minority or Low-income populations.

The population of the City of Nome is 3,697 people and includes both minority and low-income populations (DCRA 2019). As of 2016, the population of Nome was comprised of approximately 48.5 % “American Indian or Alaska Natives” (DCRA 2019). Both Alaska Native and other tribal populations are treated as minorities under E.O. 12898. There are two Federally-recognized tribes based in Nome: the Nome Eskimo Community and the King Island Native Community. Other minority populations in Nome include “Asian” (1.5 %), “Black or African American” (2.0 %), “Native Hawaiian or Pacific Islander” (0.6 %), and those individuals who identified themselves as “Two or More Races” (15.7 %) (DCRA 2019).

Income data from the U.S. Census Bureau’s 2013-2017 American Community Survey show that an estimated 11.8 % of Nome residents, regardless of minority status, have incomes below the Federal poverty level. DCRA (2019) data identify 483 persons living below the poverty level.

8.8.2.2 Identification of Adverse Impacts.

The proposed navigation improvements at the Port of Nome have the potential to temporarily adversely impact subsistence species (see Sections 8.7.3.2, 8.7.3.3, and

8.7.3.4.), and indirectly adversely impact long-term subsistence use of traditional subsistence locations (see Section 8.7.5). Specifically, the proposed project may result in the temporary displacement of subsistence species during construction. The proposed project may also indirectly result in the restriction of pedestrian access to subsistence locations near and within the Port of Nome and an increase in non-local use of subsistence locations near and within the Port of Nome. If such restriction or congestion occurs, it would likely result in an increase in the cost of obtaining subsistence resources as users would be required to travel further afield to access similar hunting and fishing opportunities.

The proposed project also has the potential to adversely impact the housing and rental market in the City of Nome. There is a history at Nome and similar communities with limited housing stock of tenants being evicted to make way for an influx of temporary workers willing to pay higher rents (ADCCED 2015). Although there are measures being taken by the local, state and federal level to help with the housing issue, if there is a housing shortage at the time of construction, and contractors are housed in rental units during project construction, it could cause a temporary inflation of rental costs and decrease the availability of housing in the community.

8.8.2.3 Determination under E.O. 12898.

The USACE has determined that the adverse impacts identified above could potentially disproportionately affect minority and low-income populations. However, the USACE has proposed mitigatory measures to avoid and minimize impacts to subsistence species during construction and has determined that the adverse impact to subsistence use is minor, as the impact is highly localized and it is not expected to *substantially* interfere with harvestable access to subsistence resources in the region or cause a *major* increase in non-rural resident use of subsistence resources.

- In order to address the potential adverse impact on housing, the contractor could, to the extent practicable, provide and maintain temporary housing (i.e., a man-camp) for its project workers.

8.8.2.4 Determination under E.O. 13045.

The USACE has determined that there would be no disproportionate health or safety risks to children as a result of the proposed action.

8.8.3 Cumulative & Long-term Impacts

The Council on Environmental Quality's (CEQ) regulations for implementing the National Environmental Policy Act (NEPA) define cumulative effects as the impact on the environment which results from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions regardless of what agency (Federal or non-federal) or person undertakes such other actions (40 CFR ~ 1508.7).

Other Port Expansion Efforts: The preferred alternative must be viewed in the context of a long-term trend of past and future development at the Port of Nome. The City of Nome's 2016 Strategic Development Plan for the Port of Nome (McDowell Group 2016) discusses numerous projects planned for the future. New development that would expand the port's capabilities and services, beyond the proposed federal project studied in this report, include (Figure 83):

- Acquisition and development of two upland areas (7 acres and 18 acres, respectively) for use in port operations;
- Deepening the Inner Harbor as part of the USACE's CAP 107 project;
- Constructing a travel lift and haul-out to serve the commercial fishing and dredge fleet;
- Widening and resurfacing a one-mile section of Port Road, a thoroughfare that bisects the port, and connects the existing causeway with the Nome road system;
- Floating docks at the mouth of the Snake River, to support commercial and recreational small vessels;
- A small boat launch facility and moorage within the Snake River;
- A wastewater pump-out station and small vessel fuel station.

These projects are not dependent upon the preferred alternative for their feasibility or implement ability, but are clearly part of a larger goal to reduce harbor congestion and to prepare harbor facilities for handling greater activity and greater through-put of commodities.

Previous major activities to improve and expand the port include (McDowell Group 2016):

- Construction of the sheet pile "Middle Dock" on the causeway (2015);
- Inner harbor "High Ramp" construction and dredging (2013);
- Inner harbor east and south dock improvements (2007-2008);
- Construction of the east breakwater, and realignment of the inner harbor entrance channel;
- Deepening and expansion of the Outer Basin (2005-2006).

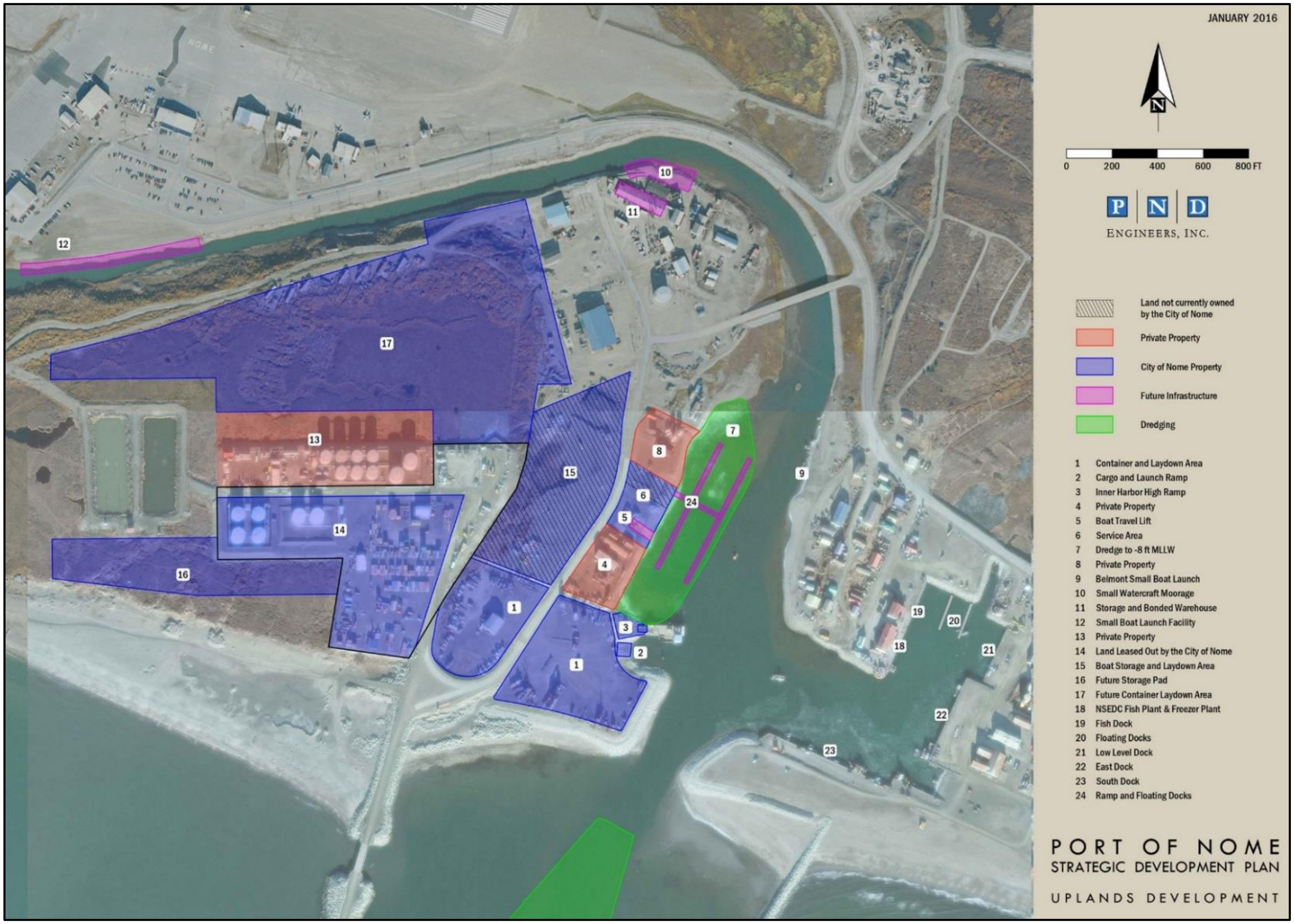

Figure 83. Upland development planned by City of Nome (adapted from McDowell Group 2016).

Increases in Shipping Traffic. The observed and anticipated increases in shipping through the Bering Strait and northern Bering Sea has been a cause of considerable environmental concern in the region (Kawerak 2016, Oceana and Kawerak 2014, Smith et al. 2017). The proposed project is, in part, a response to the increasing Bering Strait shipping traffic, and the risks and opportunities it represents. However, an expanded Port of Nome is not expected, in of itself, to create a significant further increase in shipping traffic through the Bering Strait region.

The USACE used its “HarborSym” simulation model in its economic analyses of the Port of Nome alternatives. The model captures changes in fleets and cargos over time, including calculations for within-harbor and ocean transit costs. It can develop projected vessel call lists based on commodity demand forecasts, and a harbor’s capacity for handling various sizes and numbers of ships (IWR 2019). Table 50 through Table 52 compare projected vessel calls in future years with:

- no project constructed (Table 50);
- with the recommended plan (Alternative 8b) in place (Table 51); and
- with the smallest of the structural plans (Alternative 3a) in place (Table 52).

Table 50. Projected Vessel Calls at Nome by Route Group and Year. Future Without Project

Route Group	2030	2040	2050	2079
Bering Sea Cruise	7	10	12	12
Bering Sea Patrol	18	30	40	40
Bering Sea Research	49	65	88	88
FE Tanker Route	18	22	29	29
Nome Service Area	132	167	209	209
WCUS-Nome	63	76	91	91
Total	**287**	**369**	**469**	**469**

Table 51. Projected Vessel Calls at Nome by Route Group and Year (Alternative 8b).

Route Group	2030	2040	2050	2079
Bering Sea Cruise	7	10	12	12
Bering Sea Patrol	18	30	40	40
Bering Sea Research	49	65	88	88
FE Tanker Route	18	22	29	29
Nome Service Area	132	167	209	209
WCUS-Nome	63	76	91	91
Total	**287**	**369**	**469**	**469**

Table 52. Projected Vessel Calls at Nome by Route Group and Year (Alternative 3a)

Route Group	2030	2040	2050	2079
Bering Sea Cruise	7	10	12	12
Bering Sea Patrol	18	30	40	40
Bering Sea Research	49	65	88	88
FE Tanker Route	18	22	29	29
Nome Service Area	132	167	209	209
WCUS-Nome	63	76	91	91
Total	**287**	**369**	**469**	**469**

The “Route Groups” used in the tables above are defined as follows:

- Bering Sea Cruise: Based on cruise ship schedules. Origin & destination Canada and stops in Russian, Canadian, Alaskan, and Scandinavian Arctic.
- Bering Sea Patrol: Based on sailing routes of U.S. and other government vessels. Originate in Cordova, Homer, or Kodiak and sail as far North as Barrow.
- Bering Sea Research: Based on sailing routes of research vessels. Origin & destination after Nome anywhere from South Korea to Port Clarence
- FE Tanker Route: Far East Tanker Route. Origin & Destination South Korea. Anchored at Nome, Nunavak, St. Lawrence, and Togiak Bay during voyage.
- Nome Service Area: Transshipment services from Nome. Originate in Nome and stop in several Alaskan communities before returning to Nome; Communities range from as far north as Barrow and as far south as Platinum.
- WCUS-Nome: West Coast US to Nome. Origin & destination in Seattle or Tacoma and stop in several Alaskan communities before or after arriving in Nome (e.g., Seattle, Seward, Bethel, Nome, Kotzebue, Naknek, Dillingham, Seattle).

Major points to take from the HarborSym model results in are (Appendix D [Economics]):

a. The number of vessel calls at Nome would increase over time regardless of whether a Port of Nome Modifications project is built.
b. The selection of different plans would make no difference in the number of vessel calls at Nome.

Explanations for these model results include:

a. The recommended plan allows larger ships carrying larger volumes of commodities to dock at Nome, resulting in fewer vessel calls needed to transport a given volume of goods.
b. The majority of vessels calling at Nome are delivering cargo and fuel for consumption at Nome, or are involved in the transshipment of commodities from Nome to other coastal communities. While Nome is growing, there is a limit to how fast this remote and relatively small community can grow and to the volume of commodities it can consume. Increases in the number of tourist, patrol, or research vessels making calls at Nome are expected to remain modest in comparison to the numbers of vessels delivering commodities to Nome.

<u>Magnitude of Cumulative Effects:</u> EPA guidance (USEPA 1999) recommends consideration of the specific resources and ecological components that can be affected by the incremental effects of the proposed action and other actions in the same geographic area:

- whether the resource is especially vulnerable to incremental effects;
- whether the proposed action is one of several similar actions in the same geographic area;
- whether other activities in the area have similar effects on the resource;
- whether these effects have been historically significant for this resource; and
- whether other analyses in the area have identified a cumulative effects concern.

While the proposed project and the ongoing upland efforts to expand the port facilities are related to some extent and are geographically adjacent, the two actions generally affect different resources. The proposed project's effects are almost entirely on the marine environment, with moderate effects identified on marine habitats, marine mammals, and marine essential fish habitat. The development of onshore port infrastructure primarily affects previously-impacted uplands, with some construction planned for the Snake River and Inner Harbor. Resource categories the proposed project and the upland development may affect in common include air quality, noise, and subsistence access. The geographical separation between air pollutant and noise emissions from the proposed project and upland development may prevent the effects from becoming cumulative. Subsistence users have expressed concerns about potential impacts to subsistence practices that may be caused by both the proposed project and upland port development. Such concerns regarding the proposed project tend to focus more on potential impacts to marine subsistence resources (e.g., contaminant releases from larger ships, while concerns about the upland development tend to focus on continued physical access to the Snake River and its resources (Section 8.7.5). The USACE determines that the magnitude of cumulative effects between the proposed project and on-going upland port development is, at most, moderate: some common impacts to resources may be identifiable, but should not be of a magnitude that the resources are destabilized.

The proposed project and increased Bering Strait shipping both affect marine biological resources. However, as discussed above, the construction of the proposed project is not expected to cause significantly increased vessel calls at Nome beyond the projected without-project trend (Table 50 and Table 51). In other words, there would be geographical separation between the impacts of increased regional shipping traffic and the impacts of the proposed project. The two activities also differ temporally, with most of the impacts of the proposed project happening during roughly 5 years of construction, then ceasing. The USACE determines that cumulative effects between the proposed project and increased Bering Strait traffic would not be readily discernible, and therefore of minor significance.

8.8.4 Unavoidable Adverse Impacts

The recommended plan would result in unavoidable adverse impacts, by replacing roughly 17 acres of cobble and boulder benthic habitat with rubblemound or dredged, sandy habitat. USACE and the National Marine Fisheries Service (NMFS) have agreed to develop a plan to beneficially relocate cobbles and boulders recovered during dredging.

8.8.5 Incomplete or Unavailable Information

Information that would be required before construction of the recommended plan, but which has been unavailable during Feasibility Phase, includes:

- Project-specific geotechnical information.
- Project-specific chemical and physical characterization of the material to be dredged.
- Technical evaluation of dredged material placement for beach nourishment.
- Quantitative surveys of marine mammal presence within the project area.

8.9 Summary of Mitigatory Measures

For water quality:

- Prior to the start of construction dredging, representative samples of the material to be dredged would be sampled and analyzed for a broad range of potential contaminants. The material would be tested for total organic carbon, ammonia, and sulfides. An elutriate test appropriate to the anticipated construction dredging conditions would also be performed.
- Dredging would be conducted so as to minimize the amount of suspended sediment generated.
- The contractor would be required to prepare and implement an Oil Spill Prevention and Control Plan. Reasonable precautions and controls would be used to prevent incidental and accidental discharge of petroleum products or other hazardous substances.

For air quality:

- The contractors would be required to use equipment that is in good repair and meets applicable emission standards. Best management practices such as wetting work surfaces would be applied if visible lofted dust is noted.

For airborne noise:

- High-noise activities, such as pile-driving, can be timed to minimize impacts on residential areas. Port workers can be informed of the location and timing of high-noise activities and offered hearing protection.

For protection of marine mammals:

- During all pile-driving, dredging, and other in-water work, qualified marine mammal observer(s) would be present. All observers must be able to spot and identify marine mammals and record applicable data during all types of weather during all in-water activity.
- Marine mammal observers would have the authority to enforce marine mammal exclusion zones as proposed in the draft Biological Assessment.
- Pile driving or any work with the potential to generate noise levels above 120 dB (impact and/or vibratory hammers) shall start at low intensity to allow for marine mammals to evacuate the exclusion zone.
- Proposed action-related vessels would be limited to a speed of 8 knots, or the slowest speed above 8 knots consistent with safe navigation to reduce the risk of collisions with protected species:
  - when within 3 nautical miles of any Steller sea lion haul outs or rookeries;
  - when transiting the North Pacific right whale CH areas; and
  - when transiting the Cook Inlet beluga whale CH areas.

- Vessel operators would strive not to approach within 100 yards of a marine mammal to the extent practicable, given navigational and safety constraints.

For the protection of fish and essential fish habitat:

- The timing of the proposed construction activities would be coordinated with the Alaska Department of Fish and Game.
- To the extent practicable, the existing fish passages in the causeway and breakwater would be kept passable during construction through removal of accumulated sediment as necessary.
- The recommended plan east causeway would incorporate a serviceable fish passage breach, and nearshore construction would be timed to minimize impacts on migrating fish.
- The USACE would work with the NMFS and the ADFG to develop a plan to beneficially reuse cobbles and boulders recovered during construction dredging, relocating them to deeper waters offshore where they may continue to serve as hard-bottom substrate.
- The USACE would conduct a survey of submerged portions of the existing rubblemound causeway and breakwater, establish long-term monitoring of the new/extended rubblemound structures.
- Rock for new rubblemound construction would be free of contaminants and invasive species. To the extent practicable, rock material removed from the existing rubblemound structures in the course of construction would be reused at the project site.

For the protection of cultural resources:

- An archaeological monitor who meets the Secretary of Interior's Professional Qualifications Standards would be present during all terrestrial ground-disturbing activities. The archaeological monitoring and treatment of any unexpected discoveries would adhere to the provisions identified in the MOU under development: *Memorandum of Agreement among the U.S. Army Corps of Engineers, Nome Eskimo Community, and Kawerak, Incorporated, Regarding the Proposed Navigation Improvements at the Port of Nome, Alaska*.

To minimize project impacts on subsistence use:

- The USACE would continue to consult with local Alaska Native communities to avoid and minimize the short term effects of construction on subsistence species and subsistence access, particularly with regards to the timing of construction operations.

To minimize project impacts on the Nome housing supply and on low-income populations:

- The contractor would be required, to the extent practicable, to provide and maintain temporary housing (i.e., a man-camp) for its project workers.

8.10 Comparison of the Effects of the Project Alternatives

The six structural alternatives are very similar in the type and location of their direct and indirect impacts on the existing ecological setting, differing primarily in the magnitude of those impacts. Alternatives 4a, 8a, and 8b are larger than Alternatives 3a, 3b, and 3c, and have correspondingly larger direct impacts in terms of habitat replacement. The deeper dredge depth alternatives within the deep water basin remove incrementally greater areas of existing habitat but differ little qualitatively.

Injurious noise from pile-driving is the greatest potential adverse effect on ESA-listed marine mammals. The six structural alternatives would have similar effects on ESA-listed species, differing primarily in the duration of the effects, rather than the intensity or nature of the effects.

The six structural alternatives would affect the same environment in roughly the same ways and would have similar impacts on EFH. The alternatives that extend the causeway farther out into existing -40 to -45 ft MLLW water depths (alternatives 8a and 8b) would impact more of the marine-growth-encrusted cobble habitat known to exist near the port. The longer causeway alternatives would also presumably have a greater influence on the formation of shore-fast ice.

Alternatives 3a, 3b, 3c involve no inland earthwork and have no potential to affect historic properties. Alternatives 4a, 8a, and 8b require a small amount of upland excavation related to the construction of a new eastern causeway; however, the shallow nature of the proposed construction methods would not impact any subsurface cultural resources associated with NOM-00146 or NOM-00158, which may be within the APE.

Table 53 summarizes the Magnitude determinations (as defined in Section 8.7.1) made for each resource category in Sections 8.7.2 through 8.7.5. Although the structural alternatives differ to some degree in the extent, intensity, and duration of their effects.

Table 53. Summary of Magnitude of Effects Determinations for Each Alternative and Resource Category.

Resource Category	No Action Alternative	Alt 3a	Alt 3b	Alt 3c	Alt 4	Al 8a	Alt 8b
Climate	Minor	Minor					
Wind	Minor	Minor					
Sea Ice	Minor	Minor					
Bathymetry	Minor	Minor					
Geology	Minor	Minor					
Soils & Sediments	Minor	Minor					
Tides	Minor	Minor					
Currents	Minor	Minor					
Sea Level Rise	Minor	Minor					
Water Quality	Minor	Moderate					
Air Quality	Minor	Minor					
Noise	Minor	Moderate					
Visual Resources	Minor	Minor					
Habitat & Wildlife	Minor	Moderate					
ESA-Species	Minor	Moderate					
MMPA-Species	Minor	Moderate					
Migratory Birds	Minor	Minor					
EHF	Minor	Moderate					
Special Aquatic Sites	Minor	Minor					
Cultural Resources	Minor	Minor					
Subsistence Use	Minor	Minor					

9.0 COORDINATION – PUBLIC AND AGENCY INVOLVEMENT

9.1 Public / Scoping Meetings

From 24–25 April 2018, officials from the non-Federal sponsor (The City of Nome), Sitnasuak Native Corporation, Nome Eskimo Community, Kawerak, Inc., Crowley, Howlett Engineering, PND Engineering, Alaska Marine Pilot's Association, University of Alaska Sea Grant, US Coast Guard (USCG), US Environmental Protection Agency, US Department of Transportation-Maritime Administration, US Fish and Wildlife Service, National Oceanic and Atmospheric Administration-National Marine Fisheries Services, and USACE personnel from the Alaska District, Pacific Ocean Division, Headquarters, and the Deep Draft Navigation Planning Center of Expertise participated in a charette that was held in Nome, Alaska.

The District presented to the public during the City of Nome Planning Commission's monthly meeting on 15 November 2018. The PDT held a community outreach and public scoping meeting in Nome on 18 June 2019. On 19 July and 10 August 2019, the District presented a project update in Nome during the public workshop of the Port

Commissioners Meeting. All of these presentations provided an open forum for community members to ask questions and notify the District of any concerns.

In May 2019, a draft IFREA document was released for public review (USACE 2019d). As discussed in Section 1.7, releasing a supplemental EA for public review was determined necessary because updated information about construction techniques has caused the Alaska District to reevaluate impacts to various endangered and protected marine mammal species. In addition, the District has reevaluated the NED rationale for project selection, and has determined that there is no longer an NED plan available for selection. Plan selection has been updated based on CE/ICA, as discussed in Section 6.7.

The District received a total of 167 public comments on the May 2019 draft IFREA. The most significant of these comments can be categorized into six broad topics (Table 54). Reponses to comments have been addressed in this Supplemental Draft.

Table 54. Most significant topics commented on by the public.

Comment Topic	Number of Comments
The project would have added economic benefits to the region in addition to increasing safe vessel access	22
Impacts to Alaska Native culture and subsistence resources, increased fuel/time needed to get out of the harbor and reach subsistence use areas	6
Local labor resources utilized during construction	2
Environmental and cultural mitigation	2
Sea ice effects on harbor use/improvements	1
Availability of local rock resources	1

Further coordination would be ongoing between the non-Federal sponsors, USACE, State and Federal resource agencies, and residents in the area after the draft report is available for review.

9.2 Government to Government

Representatives of two Federally-recognized Tribes (Nome Eskimo Community, Native Village of White Mountain) and three Alaska Native Corporations (Bering Straits Native Corporation, Kawerak, Incorporated, Sitnasuak Native Corporation) attended the Planning Charette in Nome on 24–25 April 2018. The Nome Eskimo Community requested Government-to-Government consultation on 25 April 2018. In September 2018, the following Federally-recognized tribes in the Nome region were notified of the proposed project under the USACE Tribal Coordination and Government-to-Government Procedures (CEPOA-7.1-14):

- Nome Eskimo Community
- King Island Native Community
- Inupiaq Village of Council

- White Mountain IRA Council

The USACE held Government-to-Government consultation in Nome on 3 October 2018 and on 27 March 2019. Representatives of Nome Eskimo Community and Kawerak, Incorporated attended. The discussions centered on cultural, social, and economic impacts that may result from the proposed project.

Specific concerns brought up in the meeting included (Floyd 2018):

1. A large construction project that brings in many workers from outside Nome can distort the limited Nome housing market, in both the short term and long term. Nome residents may be evicted from rental housing to make room for higher-paying outside workers, and the elevated rental rates may not go down again after the project is completed and the workers leave. Requiring the contract companies to provide their own camps for the workers they bring in may alleviate the strain on local housing, but using as many local hires as possible would be preferable.

2. A large construction project that brings in many workers from outside Nome puts a strain on already-limited Nome law enforcement and emergency response.

3. Local workers should receive training and be hired for the construction.

4. State game regulations allow non-residents to conduct fly-in hunts from Nome; a large influx of construction workers taking advantage of this regulation can compete with Nome residents for a limited stock of game.

5. Local access to the Snake River must be maintained for both launching small craft and for pedestrian users. For many Native residents lacking transportation, the Snake River and the Nome shoreline is their only direct access to subsistence resources.

6. The finished Port project would allow larger vessels to dock; this may bring in larger commercial fishing vessels, which may out-compete small family fishing businesses for limited fish and crab stocks.

7. The expanded Port is supposed to allow large fuel tankers to dock, eliminating the need for the current practice of lightering fuel onto smaller vessels. However, the lightering practice may still continue, especially if high moorage fees discourage vessel operators from making use of the port.

8. More ship traffic and larger vessels using the port would increase the risk, in frequency and severity, of fuel spills and wastewater releases. Such pollution may contaminate marine mammals and fish moving through the port, making them inedible to future subsistence users. Spills at the port would disproportionately affect poorer subsistence users, which depend on the Snake River and other resources close to Nome.

9. More ship traffic and larger vessels using the port increases the risk of incidents that would overwhelm existing Coast Guard, spill response, and emergency medical response capacities.

10. More ship traffic and larger vessels using the port may affect marine mammals and their migration movements.

11. Cultural resources in the general project area, which include the Snake River Sandspit Village Site and the Sitnasuanmiut Qunuwit Cemetery, must be protected. Agreement documents (e.g., Memorandum of Agreement) with the Nome Eskimo Community and Kawerak regarding a plan for the inadvertent discovery of human remains or cultural materials would be finalized prior to construction.

12. In general, the Native community at Nome feels that its cultural identity is at risk from long term economic and demographic changes at Nome and that infrastructure development projects like the Port of Nome Modification tend to accelerate those changes. The Native community at Nome wants assurances that the project would not further displace Native residents, or limit their cultural practices.

This ongoing Government-to-Government consultation would result in the execution of a *Memorandum of Agreement among the U.S. Army Corps of Engineers, Nome Eskimo Community, and Kawerak, Incorporated, regarding the Proposed Navigation Improvements at the Port of Nome, Alaska*.

9.3 Federal & State Agency Coordination

Planning Charrette – April 2018:

- NMFS – Habitat
- USCG
- USEPA
- US Department of Transportation – Maritime Administration
- USFWS

While in project development:

NMFS – Habitat
- EFH kick-off meeting with NMFS – 11 July 2018.
- USACE submits EFH Assessment to NMFS – 15 January 2019.
- NMFS provides letter of concurrence and EFH conservation recommendations – 5 May 2019.

NMFS – Protected Resources
- USACE submits preliminary ESA and MMPA species lists to NMFS (email) – 9 May 2018.

- NMFS confirms ESA and MMPA species lists (email) – 18 May 2018.
- USACE submits ESA determination letter to NMFS – 31 December 2018.
- NMFS requests additional information (emails) – 20 February to 28 March 2019.
- USACE provides additional information to NMFS (emails) – 20 February to 2 April 2019.
- NMFS provides letter declining concurrence until sufficient project information is available – 22 April 2019.
- USACE responds by letter to NMFS – 3 May 2019.

State of Alaska Division of Water

- Agency review for CWA 401 Water Quality Certification is initiated concurrently with public/agency review of IFREA – 9 May 2019.
- A provisional water quality certification pursuant to section 401 of the Clean Water Act was issued by the Alaska Department of Environmental Conservation (ADEC) Division of Water on 12 July 2019.

State of Alaska SHPO

- USACE submits determination of “no adverse effect on historic properties” [36 CFR § 800.5(b)] – 8 April 2019.
- SHPO concurs with determination – 7 May 2019.

USFWS

- ESA, FWCA kick-off meeting with USFWS; USFWS states it will not participate in FWCA – 23 May 2018.
- USACE submits preliminary ESA species list to USFWS (email) – 25 May 2018.
- USFWS confirms ESA species list (email) – 29 May 2018.
- USACE submits ESA determination letter – 26 December 2018.
- Teleconference with USFWS about determination letter – 15 February 2019.
- USACE submits revised ESA determination letter – 28 February 2019.
- USFWS provides requested letter declining FWCA – 11 March 2019.
- USFWS provides ESA letter of concurrence – 12 March 2019.

USFWS and NMFS guidance on ESA Section 7 consultations (USFWS & NMFS 1998) describes two tracks for informal consultation. By regulation, a biological assessment (BA) is prepared for Federal actions considered to be "major construction activities" significantly affecting the quality of the human environment, as referred to in the National Environmental Policy Act of 1969 (NEPA) (42 U.S.C. 4321 et seq.). The action agency is not required to prepare a BA for actions that are not major construction activities as defined by the NEPA, but, if a listed species or critical habitat is likely to be affected, the agency must provide the USFWS and/or the NMFS with an account of the basis for evaluating the likely effects of the action. The USFWS and/or the NMFS use this documentation along with any other available information to decide if concurrence with the action agency's determination is warranted.

The NMFS declined to concur with the USACE's determination of "may affect, but not likely to adversely affect" ESA-listed species in its 22 April 2019 letter, citing insufficient project construction information. Subsequently, additional project scoping information was developed by the PDT, indicating a need for substantially more pile driving than was originally scoped. The USACE decided that a "may affect, but not likely to adversely affect" determination was no longer supportable, and would pursue formal consultation with the NMFS when adequate construction materials and methods information is available to assess project impacts (primarily underwater noise) to ESA-listed marine mammals. The ESA formal consultation would also inform evaluations of takings under the MMPA.

9.4 Status of Environmental Compliance

The compliance status with relevant Federal and State regulations and with relevant Executive Orders is summarized in Table 55.

Table 55. Status of Compliance with Federal and State Regulations, and Executive Orders

Federal Statutory Authority	Compliance Status	Compliance Date / Comment
Clean Air Act	FC	Project site not in non-attainment area; conformity requirements do not pertain.
Clean Water Act	PC	Provisional 401 WQC received, contingent upon characterization of dredging prism.
Coastal Zone Management Act	FC	The State of Alaska withdrew from the voluntary National Coastal Zone Management Program on 1 July 2011. Therefore, within the State of Alaska, Federal agencies are not required to ensure their activities are consistent with an approved State coastal management plan.
Endangered Species Act	PC	Sec 7 consultation with the NMFS would continue into PED
Marine Mammal Protection Act	PC	MMPA coordination with the NMFS would continue into PED
Magnuson-Stevens Fishery Conservation and Management Act	FC	NMFS concurrence received.
Fish and Wildlife Coordination Act	FC	USFWS invited to FWCA coordination but declined.
Marine Protection, Research, and Sanctuaries Act	FC	Discharges would be subject to CWA, not MPRSA.
Migratory Bird Treaty Act	FC	No takings under the MBTA are anticipated.
National Historic Preservation Act	FC	SHPO concurrence received.
National Environmental Policy Act	PC	NEPA compliance will be complete upon review of IFREA and signing of FONSI (Appendix K).
Executive Order 11990: Protection of Wetlands	FC	No impacts to wetlands anticipated.
Executive Order 12898: Environmental Justice	FC	Low-income and minority populations and potential disparate impacts have been evaluated, and addressed to the extent practicable.
Executive Order 13045: Protection of Children from Environmental Health Risks and Safety Risks	FC	No disparate impacts on the health or safety of children are identified.
Executive Order 13186: Protection of Migratory Birds	FC	No significant direct or indirect effects on migratory birds are anticipated.

9.5 Views of the Sponsor

The sponsor, the City of Nome, has funded the study up to $1.42M and are awaiting the Federal cost-share match to provide the remaining funds. The City has also been an active participant in the study. It is noted that the project is of high priority for the community and region to facilitate efficient transportation of goods, fuel, equipment, and materials. The project would improve navigation efficiency to reduce the costs of commodities critical to the viability of communities in the region.

The sponsor has also expressed that passenger (pedestrian) and industrial traffic (vessel loading and off-loading equipment), although currently managed to the extent possible on the existing causeway with signage and temporary barriers, compete for dock space, which impedes operations at other dock faces during fueling, off-loading and loading and causes safety concerns. These conflicts would increase as traffic continues to increase, and the situation would be further exacerbated when the deep water docks host a large passenger vessel (Joy Baker, Port of Nome Director, personal communication 2019). Additionally, it would be impractical to have both USCG and civilian passengers at nearby berths with only one causeway (Joy Baker, personal communications 2019). With a single causeway, pedestrians would continue to compete for the same road and maneuvering space as the heavy equipment, and using busses for larger numbers of passengers would have to occur with big vessels on the outer dock. Having docks on both sides of the harbor would enhance safety, security, reduce congestion, conflicts, and provide unimpeded operations for industrial, USCG, and cruise ships. Having an east causeway and dock would also allow for a more economic expansion of potential berthing areas to maximize the capabilities of the facility. In addition, when both foreign-flagged and domestic vessels are in port, or if a vessel was in distress or being processed by USCG or Canadian Border Patrol (CBP), an east side dock would be essential to manage and service all the vessels without delays. The separation allowed by having an east and west causeway would become even more substantially necessary as vessel traffic increases and refueling/resupply demand at Nome escalates - requiring a long-term view on important facility configuration elements.

Up to date Letters of Intent/Interest from sponsors have been requested, and will be added to Appendix G (Correspondence) when received. Updated letters of intent and statements of financial capability will be included in the final report that note the sponsors' ability to comply with cost-sharing and financial policies during design and construction.

9.6 Letters of Support

Support from the State of Alaska is demonstrated by House Joint Resolution No.14 dated 25 April 2019, which was passed with almost unanimous support in May 2019. This Resolution urges the Alaska Congregational delegation to pursue funding for a deep draft Arctic port in Nome, and requests that the ADOT&PF to support the Alaska

Congressional delegation and work collaboratively with the City of Nome. The ADOT&PF provided a letter of support dated 10 September 2019; which states that "the time for a Nome Deep-Draft Port project is now." There is also a letter from the City of Nome dated 9 September 2019 that transmits the Alaska Marine Pilots LLC, Marine Pilot Report dated 26 August 2019, in which Alternative 8b is identified as "the best option in every respect." The letters referenced above are presented in Appendix G (Correspondence).

10.0 PREPARERS OF THE ENVIRONMENTAL ASSESSMENT

The Environmental Assessment was prepared by members of the USACE Alaska District Environmental Resources Section, Hydraulics & Hydrology Section, and Civil Works Branch (Table 56).

Table 56. Preparers of the Environmental Assessment

Name	Title	Degree	Responsibilities:
Andrew Bazzle	Economist	Economics (M.S.)	Socio-Economics Conditions; Existing Fleet, Commodities Transported, Waterways, Dock, and Operating Cost; Economic and Political Conditions; Vessel Traffic
Jenipher Cate	Chief of Project Management	Marine Ecology (Ph.D.)	Executive Summary, Coordination, Recommendations, Oversight and guidance
Kelly Eldridge	Archaeologist	Anthropology (M.A.)	Cultural Resources, Subsistence Use, Environmental Justice & Protection of Children
Christopher Floyd	NEPA Planner	Biochemistry & Molecular Biology (M.S.)	EA management; Climate, Wind, Geology, Water and Air Quality, Noise, Visual Resources, Marine Mammals, Unavoidable Adverse Impacts, Cumulative & Long-term Impacts, Subsistence Use, Environmental Justice & Protection of Children, 404(b)(1) analysis
Michael Salyer	Chief of Environmental Resources	Biology (M.S.)	Oversight and guidance of EA development; independent review of EA for accuracy and compliance with CEQ regulations
Cynthia Upah	Chief of Planning	Biology (M.S.)	Oversight and guidance of FR development; independent review of FR for accuracy and compliance with USACE regulations

11.0 CONCLUSIONS & RECOMMENDATIONS

11.1 Conclusions

The alternatives carried forward were evaluated using the NED analysis (Section 6.4) and CE/ICA for OSE (Section 6.5) without national security benefits and with national security benefits. No NED plan was identified, with or without national security benefits. The CE/ICA, without national security benefits, identified three Best Buy plans (No Action and Alternatives 4a and 8a), and two Cost-Effective plans (Alternative 3a and 8b). When considering national security, Alternative 8a is changed to Not Cost-Effective, and the formerly Cost-Effective plans become Best Buy plans. Alternative 8b was ultimately identified as the TSP because it is a Cost-Effective plan that is also supported by the Alaska Marine Pilots LLC (see discussion in Section 6.2 and Section 6.7), which identified safety and maneuverability concerns associated with Alternative 4a; which includes by association the other smaller plans (Alternative 3a, 3b, and 3c).

Alternative 8b is optimized by combining various measures to minimize project cost and still meet the identified objectives and avoid identified constraints. The proposed construction of Alternative 8b, as discussed in this document, would have short-term environmental impacts during construction that would be largely minimized by observing work shut-down radii as would be developed during post-Feasibility formal consultation with the NMFS and the USFWS. In the long-term, impacts would be minor or minimized with the potential fish and marine mammal passage, as discussed in this report. The proposed project would adversely affect EFH in minor, localized ways that can be largely offset through mitigatory measures observed during construction, and through effective management and enforcement of spill prevention and response at the expanded port.

This assessment supports the conclusion that the proposed project does not constitute a major Federal action, significantly affecting the quality of the human environment. Therefore, a Finding of No Significant Impact (FONSI) has been prepared (Appendix K).

11.2 Recommendations

I recommend that the navigational improvements at Nome, Alaska, be constructed generally in accordance with the plan herein, and with such modifications thereof as in the discretion of the Chief of Engineers may be advisable at an estimated total Federal cost of $391,218,380 for Alternative 8b with a Deep Water Basin dredged to -40 ft MLLW and the Outer Basin to -28 ft MLLW, provided that prior to construction the local sponsor agrees to the following:

a. Provide, during the periods of design and construction, funds necessary to make its total contribution for commercial navigation equal to:

(1) 10 % of the cost of design and construction of the general navigation features attributable to dredging to a depth, not in excess of -20 ft mean lower low water (MLLW), plus

(2) 25 % of the cost of design and construction of the general navigation features attributable to dredging to a depth in excess of -20 ft MLLW but not in excess of -50 ft MLLW, plus

(3) 50 % of the cost of design and construction of the general navigation features attributable to dredging to a depth in excess of -50 ft MLLW.

b. Provide all lands, easements, rights-of-way, and relocations, including those necessary for the borrowing of material and placement of dredged or excavated material, and perform or assure performance of all relocations, including utility relocations, as determined by the Federal government to be necessary for the construction or operation and maintenance of the general navigation features;

c. Pay with interest, over a period not to exceed 30 years following completion of the period of construction of the general navigation features, an additional amount equal to 10 % of the total cost of construction of the National Economic Development Plan general navigation features less the amount of credit afforded by the Federal government for the value of the lands, easements, rights-of-way, and relocations, including utility relocations, provided by the non-Federal sponsor for the general navigation features. If the amount of credit afforded by the Federal government for the value of lands, easements, rights-of-way, and relocations, including utility relocations, provided by the non-Federal sponsor equals or exceeds 10 % of the total cost of construction of the general navigation features, the non-Federal sponsor shall not be required to make any contribution under this paragraph, nor shall it be entitled to any refund for the value of lands, easements, rights-of-way, and relocations, including utility relocations, in excess of 10 % of the total costs of construction of the general navigation features;

d. Provide 50 % of the excess cost of operation and maintenance of the project over that cost which the Secretary determines would be incurred for operation and maintenance if the project had a depth of 50 ft;

e. Prevent obstructions or encroachments on the project (including prescribing and enforcing regulations to prevent such obstructions or encroachments) such as any new developments on project lands, easements, and rights-of-way or the addition of facilities which might reduce the outputs produced by the project, hinder operation and maintenance of the project, or interfere with the project's proper function;

f. Provide, operate, and maintain, at no cost to the Federal government, the local service facilities in a manner compatible with the project's authorized purposes and in accordance with applicable Federal and state laws and regulations and any specific directions prescribed by the Federal government;

g. Give the Federal government a right to enter, at reasonable times and in a reasonable manner, upon property that the non-Federal sponsor owns or controls for access to the project for the purpose of completing, inspecting, operating, maintaining, repairing, rehabilitating, or replacing the project.

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

i. Keep, and maintain books, records, documents, and other evidence pertaining to costs and expenses incurred pursuant to the project, for a minimum of 3 years after completion of the accounting for which such books, records, documents, and other evidence are required, to the extent and in such detail as will properly reflect total cost of the project, and in accordance with the standards for financial management systems set forth in the Uniform Administrative Requirements for Grants and Cooperative Agreements to State and local governments at 32 CFR, Section 33.20;

j. Perform, or ensure performance of, any investigations for hazardous substances that are determined necessary to identify the existence and extent of any hazardous substances regulated under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), 42 USC 9601-9675, that may exist in, on, or under lands, easements, rights-of-way, relocations, and disposal areas that the Federal government determines to be necessary for the construction or operation and maintenance of the general navigation features. However, for lands, easements, or rights-of-way that the Federal government determines to be subject to the navigation servitude, only the Federal government shall perform such investigation unless the Federal government provides the non-Federal sponsor with prior specific written direction, in which case the non-Federal sponsor shall perform such investigations in accordance with such written direction;

k. Assume complete financial responsibility, as between the Federal government and the non-Federal sponsor, for all necessary cleanup and response costs of any hazardous substances regulated under CERCLA that are located in, on, or under lands, easements, rights-of-way, relocations, and disposal areas required for the construction or operation and maintenance of the project;

l. Agree, as between the Federal government and the non-Federal sponsor, that the non-Federal sponsor shall be considered the operator of the local service facilities for the purpose of CERCLA liability, and, to the maximum extent practicable, perform its obligations related to the project in a manner that will not cause liability to arise under CERCLA;

m. Comply with Section 221 of Public Law 91-611, Flood Control Act of 1970, as amended, (42 U.S.C. 1962d-5b) and Section 101(e) of the WRDA 86, Public Law 99-662, as amended, (33 U.S.C. 2211(e)) which provide that the Secretary of the Army shall not commence the construction of any water resources project or separable *element thereof, until the non-Federal sponsor has entered into a written agreement to furnish its required cooperation for the project or separable element;*

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

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

p. Not use funds from other Federal programs, including any non-federal contribution required as a matching share therefore, to meet any of the non-Federal sponsor's obligations for the project unless the Federal agency providing the funds verifies in writing that such funds are authorized to be used to carry out the project.

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

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

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PHILLIP J. BORDERS Date

COL, EN
Commanding

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