Vol. I

U.S. Army Corps of Engineers
Alaska District

Navigation Improvements
Draft Interim Feasibility Report

DeLong Mountain Terminal, Alaska

September 2005

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U.S. ARMY ENGINEER DISTRICT, ALASKA
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DELONG MOUNTAIN TERMINAL NAVIGATION IMPROVEMENTS, ALASKA

DRAFT INTERIM FEASIBILITY REPORT

Vol. I

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EXECUTIVE SUMMARY

The Alaska District, U.S. Army Corps of Engineers (Corps) and the Alaska Industrial Development and Export Authority (AIDEA) have partnered to study navigation improvements for the port facilities that were originally constructed in the 1980s to serve the Red Dog Mine. The Environmental Protection Agency, the National Park Service, and the Northwest Arctic Borough (NWAB) have participated in the study as cooperating agencies for preparation of the Environmental Impact Statement. The existing port facilities, referred to in this report as Portsite, provide for storage of base metal concentrates, and a barge loading and lightering system to move the materials onto ocean going bulk carriers for delivery to smelters in North America, Asia, and Europe. This draft interim feasibility study was conducted in partial response to the *1970 Rivers and Harbors in Alaska* Study Resolution of the U.S. House of Representatives Committee on Public Works, which directed a review of past Corps' report recommendations in the study area with a view to determining whether any modifications of past recommendations are advisable at this time.

The purpose of this draft Interim Feasibility Report (draft IFR) is to document the planning and formulation of the tentatively recommended plan. The report also identifies requirements and responsibilities associated with the project implementation, operation, and maintenance. The main text of the report summarizes major technical studies conducted. Appendixes provide detailed descriptions of study methodologies and findings. The report is accompanied by a draft Environmental Impact Statement published under separate cover.

The tentatively recommended plan includes construction of an approximately 18,500-foot-long, 53-foot-deep dredged channel leading to a 1,450-foot-long trestle, carrying a roadway and enclosed concentrate conveyor from shore to a deep-draft dock, where the concentrate would be transferred to shiploaders for loading Panamax and Handysize bulk vessels. In addition, the dock has the capability to offload ocean going fuel tankers, with the fuel being stored in the existing Portsite fuel tank farm. The fuel would then be used for operations of Red Dog Mine and Portsite, and would be transshipped with lower fuel cost through the existing lightering barge dock to coastal and riverine fuel barges to serve numerous villages in northwestern arctic Alaska. The tentatively recommended project would provide the annual capacity for a projected throughput of 1,544,000 short wet tons (swt) of base metal concentrate and import of about 52,700,000 U.S. gallons of fuel with 22,600,000 U.S. gallons to be used by the mine and the port, and the remainder transshipped to numerous villages in northwestern arctic Alaska.

Project costs are allocated to the commercial navigation purpose. The tentatively recommended plan is the National Economic Development (NED) plan and is supported by AIDEA, the local sponsor. The estimated first cost of the general navigation features (GNF) of the tentatively recommended plan based on October 2004 price levels is $69,866,774. The GNF includes channel and turning basin excavation and dredged material disposal. In accordance with Section 101 of WRDA 1986, as amended, the Federal and non-Federal shares of GNF for a 53-foot channel are estimated to be $44,027,764 and $25,839,010, respectively. In addition, the Federal Government would incur the costs of navigation aids currently estimated to be $34,000. The non-federal portion includes 25 percent of the cost of the GNF features above a 45-foot design depth and 50 percent of the cost of the GNF features below the 45-foot design depth. An additional 10 percent of the total costs allocated to GNF ($6,986,677), is required to be reimbursed by the non-federal sponsor, including interest, less credit for lands, easements, rights-of-way, and relocations over a period not to exceed 30 years. Non-creditable non-federal lands, easements, rights-of-way, and relocations (except utilities) are estimated to be $13,318.

In addition to this amount, the local sponsor, AIDEA, will be investing $155,452,622 in local service facilities, which include: a trestle-supported conveyor gallery and truck access from shore to a dock with a single Panamax-sized deep-draft ship berth, dual concentrate shiploaders, facilities for transshipment of fuel, and associated shoreside facilities. Total cost for all features required to obtain the projected navigation benefits, including GNF, lands, easements, rights-of-way, relocation, local service facilities, and aids-to-navigation are estimated to be $230,419,771.

Total average annual charges, based on a discount rate of 5-3/8 percent and a 50-year period of economic analysis, are estimated to be $22,339,308. Average annual benefits are estimated at $26,898,700 with total net benefits of $4,559,392. The benefit-to-cost ratio is 1.20 to 1. The average annual cost for operation and maintenance (O&M) of the tentatively recommended plan is estimated to be $7,795,705, including $636,534 for the U.S. Army Corps of Engineers to conduct periodic hydrographic surveys of the channel and maintenance dredging of the entrance channel and turning basin (100 percent of the dredging costs for a 45-foot design and 50 percent of the excess dredging costs for a design channel greater than 45 feet deep). The annual cost for the local sponsor to operate and maintain the local service facilities, including maintenance dredging of the berthing area and 50 percent of the O&M dredging attributable to a design channel deeper than 45 feet, is $7,159,171. The U.S. Coast Guard would maintain the navigation aids at an annual cost of $1,000.

PERTINENT DATA

Tentatively Recommended Plan (Alternative 11 with 53-foot channel)

General Navigation Features		Local Service Facilities	
New Navigation Channel		**Trestle Type**	**Steel Through Truss**
Channel Depth	–53 ft MLLW	Length	1,450 ft
Channel Width		Roadway Type	Concrete Surface
Seaward Entrance	500 ft	Width/Clearance	18 ft horizontal width
Station 211+89			22 ft. vertical clearance
Station 60+97	760 ft	Enclosed Conveyor	One Initial,
			Capability for Second
Station 48+22	1,169 ft	Fuel Oil Pipeline	12-in. Diameter
Station 43+22	1,165 ft	**Concentrate Shiploaders**	**Twin Fixed Radial**
Station 35+62	523 ft	Capacity	2,600 Tons Per Hour Each
Station 26+12	213 ft	**Deep-Draft Cargo Dock**	**DeLong Jack-Up**
Turning Basin Width		Dimensions	90 ft By 300 ft
Station 60+97	0, Begin Basin	**Marine Foundations**	**Trestle and Dock**
Station 48+22	431 ft	Cellular Sheetpile	Two, 74 ft Diameter
Station 43+22	435 ft	Conical Piers	Eight, Each Seven Pile
Station 35+62	0, End Basin		
Navigational Aids	Two Range Towers	Berthing Area Size	358 ft By 950 ft
Dredging Volume	**3:1 Side Slopes**	**Dredging Volume**	**3:1 Side Slopes**
Channel[1]	5,189,829 yd^3	Berthing Area[2]	493,278 yd^3
Turning Basin[3]	562,077 yd^3	RODFEM	92,705yd^3
RODFEM[4]	1,803,485 yd^3	Total	585,983 yd^3
Total	7,555,391 yd^3		
		Shoreline By-Pass Dredging	26,000 yd^3
Dredging Area		**Dredging Area**	
3:1 Side Slopes Initial	338 ac	3:1 Side Slopes Initial	11 ac
10:1 Side Slopes	430 ac	10:1 Side Slopes	20 ac
Disposal Site	**Open Ocean**	**Disposal Site**	**Same As GNF**
Location	2 mi SW Channel Start	Location	2 mi SW Channel Start
Area	2 X 4.3 mi (About 5,600 ac)	Area	2 X 4.3 mi (About 5,600 ac)
Water Depth	-62 To -72 ft MLLW	Water Depth	-62 To -72 ft MLLW
		Wetland Fill	**70,000 yd^3 On 2.5 ac**

[1] Includes 434,821 cy Allowable Overdepth dredging
[2] Includes 19,186 cy Allowable Overdepth Dredging
[3] Includes 41,107 cy Allowable Overdepth Dredging
[4] Required Overdepth Dredging for Efficient Maintenance

PROJECT COST[A]

Item	Federal ($000)	Non-Federal ($000)	Total ($000)
General Navigation Features[b]	44,028	25,839	69,867
Additional 10% GNF minus LERR over 30 years	–6,986	6,986	
Final GNF Cost Sharing Total	37,041	32,826	69,867
Local Service Facilities (LSF)	0	160,553	160,553
Fish and Wildlife Mitigation (incl in LSF)	0	0	0
LERR (incl in LSF)	0	0	0
Navigation aids - U.S. Coast Guard	34	0	34
TOTAL NED[c] COST (Commercial Navigation)	37,075	193,379	230,420
Interest During Construction (IDC)			20,416
NED Total Investment Cost (TIC)			250,836
Annualized Cost ofTIC			14,544
Annual Operation & Maintenance Cost	637	7,159	7,796
Total Average Annual NED Cost			22,339
Average Average Annual NED Benefit			26,899
Net Average Annual NED Benefit			4,559
Benefit to Cost Ratio			1.20 to 1.0

[a] Basic assumptions: (1) October 2004 price levels; (2) 50-year project life; (3) 5-3/8% interest

[b] Cost sharing reflects provisions of the Water Resources Development Act of 1986 - non-federal initial share for -20 to -45 MLLW 25% of GNF cost plus non-federal initial share for >-45 MLLW 50% of GNF cost plus reimbursement of 10% GNF cost over 30 years minus LERR credit

[c] NED = National Economic Development

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CONVERSION TABLE FOR SI (METRIC) UNITS

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

Multiply	By	To obtain
cubic feet	0.0283	cubic meters
cubic yards	0.7646	cubic meters
acre	0.4049	hectare
Fahrenheit degrees	*	Celsius degrees
feet	0.3048	meters
feet per second	0.3048	meters per second
inches	0.396	centimeters
knots (international)	0.5144	meters per second
miles (U.S. statute)	1.6093	kilometers
miles (nautical)	1.8520	kilometers
square miles	2.590	square kilometers
miles per hour	1.6093	kilometers per hour
pounds (mass)	0.4536	kilograms
short ton (2,000 lb)	0.9072	megagram
U.S. gallon	3.7854	liter
part per million	1.0000	milligram per liter

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

GLOSSARY

Alluvium: Material deposited by moving water.

Ballasting: Filling of the ship's ballast tanks with sea water for stability and maneuverability.

Bathymetry: The measurement of depths of water in oceans, seas, and lakes.

Berthing Tug: A tug boat used to assist with vessel berthing and deberthing, or as an escort when entering or leaving an area with restricted vessel maneuverability.

Bollard: A mooring device mounted on a dock that is used for securing a ship's mooring line.

Borrow Site: Site from which construction materials would be extracted.

Channel: The part of a body of water deep enough to be used for navigation through an area otherwise too shallow for navigation.

Controlling Depth: The least depth in the navigable parts of a waterway, governing the maximum draft of vessels that can enter.

Cost Apportionment: The process by which construction and operation & maintenance costs for a project are divided between the Federal Government and the non-federal local project sponsor.

Day Mark: A visual navigational aid used by pilots for aligning a ship's path with a channel or fixing a position.

Dead Weight Tonnage (dwt): The rated capacity of an ocean-going vessel.

Design Capacity: The capacity on which basis design calculations are made. Usually, the design capacity equals the peak capacity or higher, depending on the degree of "safety factors" applied.

Demurrage: A delay penalty paid by the exporter to the buyer-charterer for loading a shipping parcel at a lower rate than the Standard Loading Rate.

Draft: The vertical distance between a ship's waterline and its keel.

Fender System: Shock absorbing devices mounted on a dock designed to withstand the impact of a ship.

Fetch: The area in which waves are generated by a wind having a constant direction and speed.

General Navigation Features: Features of a project that can be paid for in part by the Federal Government through the Corps of Engineers (e.g., breakwaters, dredged channels, jetties).

Gravity Structure: A structure that derives its lateral load resistance primarily by virtue of its weight. (e.g., caissons and sheetpile cells).

Handysize (ship): Ships in the 10,000–34,999 dwt size range.

Handymax (ship): Ships in the 35,000–49,999 dwt size range.

Hatch Changes: The process of moving the shiploader from one hatch to another hatch of a ship.

Ice Scour: Ice forms in the open ocean and along the shore. As ice moves, it cracks, breaks, merges, often forming pressure ridges that have deep keels that impact and scour the near-shore sea bottom and the beach.

Jackup Barge: A floating barge equipped with retractable legs and jacks. After floating the barge into position, the legs are lowered to the sea bottom, and the jacks are used to elevate the barge hull on the legs to an elevation above the surface of the water.

Knot: A speed of one nautical mile per hour (one nautical mile = 1852 meters or 6,076.115 feet)

Lighter: A barge used for transporting goods between ships and shore in shallow water.

Littoral Drift: The sedimentary material moved in the littoral zone under the influence of waves and currents.

Littoral Zone: An indefinite zone extending seaward from the shoreline to just beyond the breaker zone.

Load (sediment load): The quantity of sediment transported by a current, including the suspended load of small particles, and the bedload of large particles that move along the bottom.

Local Service Facilities: Features of a project that must be entirely paid for by the local sponsor (e.g., docks, berthing areas, floats, upland facilities).

Mean Lower Low Water: The average height of the lower low waters over a 19 year period. The lower low waters are the lowest of the two low waters in any tidal day.

Mooring Buoy: A floating buoy equipped with a mooring hook that is used for mooring a ship at a berth.

Nautical Mile: The length of a minute of arc, 1/21,600 of an average great circle of the earth. Generally one minute of latitude is considered equal to one nautical mile. One nautical mile = 6,076.115 feet or 1.15 statute miles or 1,852 meters.

National Economic Development Plan (NED Plan): The alternative plan that maximizes national economic development according to COE criteria.

Optimization: The application of a technique to identify parameters that maximize net economic benefit.

Panamax (ship): A ship whose dimensions just allow transits of the Panama Canal. Panamax vessels are usually in the 50,000 to 79,999 dwt range.

Polynya: Semi-permanent open lead in sea ice.

Portsite: The geographical site along the Chukchi Sea where the DMT was constructed.

Queuing Time: The time that the ship waits at the anchorage for a suitable berth to become available.

Reclaim Conveyor: Open conveyor within the concentrate storage building. Front end loaders reclaim material from the concentrate stockpiles within the sheds and load this material into mobile hoppers, which feed material onto the reclaim conveyor.

Refraction: The process by which the direction of a wave moving in shallow water at an angle to the contours is changed. The part of the wave advancing in shallower water moves more slowly than the part still advancing in deeper water, causing the wave crest to bend toward alignment with the underwater contours.

Revetment: A facing of stone, concrete, etc. built to protect an embankment or shore structure against erosion by wave action or currents.

Rock Anchor: In the context of a piled marine structure, a rock anchor is a method of anchoring piling to underlying bedrock, as a means of resisting uplift forces generated by lateral loads on the structure (generally caused by ice, waves, wind, or ship berthing).

Runup: The rush of water up a structure or beach on the breaking of a wave. The amount of runup is the vertical height above stillwater level that the rush of water reaches.

Safety Clearance: A ship's factor that provides a safety factor, under a ship's keel, based on the geotechnical analysis of seabed materials.

Scope: Area needed for a vessel to swing around its anchor.

Scour: Removal of underwater material by waves and currents, especially at the base or toe of a shore structure.

Short Wet Ton: Actual shipping weight including contained moisture.

Significant Wave Height: The average height of one-third of the highest waves of a given wave group.

Seismic: Related to or caused by earthquakes or man-made earth tremors.

Shiploader: The equipment mounted on the dock structure used to load concentrate into the hold of a ship. The shiploader contains a conveyor on a boom structure, which is used to direct the concentrate into the hold of the ship.

Squat: A hydrodynamic effect on a ship's hull while underway that varies with vessel speed, water depth under the keel, and the ratio of vessel cross-section to channel cross-section.

Storm Surge: A rise above normal water level on the open coast due to the action of wind stress on the water surface.

Tombolo: A sand or gravel bar connecting an island with the mainland or another island.

Warping: The process by which a ship is moved back and forth along a dock to allow all ship hatches and holds to be reached by loading equipment.

Wave Height: The vertical distance between a crest and a preceding trough.

Wave Period: The time for a wave crest to traverse a distance equal to one wavelength. The time for two successive wave crests to pass a fixed point.

Wave Response: A hydrodynamic effect on a ship's hull caused by waves.

Wind Setup: The difference in stillwater levels on the windward and leeward sides of a body of water caused by wind stresses on the surface of the water.

UNITS, ABBREVIATIONS, AND ACRONYMS

ac	acres
ACHP	Advisory Council of Historic Preservation
ACMP	Alaska Coastal Management Program
ADEC	Alaska Department of Environmental Conservation
ADF&G	Alaska Department of Fish & Game
ADGC	Alaska Department of Governmental Coordination
ADNR	Alaska Department of Natural Resources
ADT&PF	Alaska Department of Transportation & Public Facilities
AIDEA	Alaska Industrial Development & Export Authority
AMEC	AGRA Simons, H.A. Simons, Ltd.
AMNWR	Alaska Maritime National Wildlife Refuge
ANCSA	Alaska Native Claims Settlement Act of 1971
ANILCA	Alaska National Interest Lands Conservation Act of 1980
AOD	Allowable Overdepth Dredging
ASA (CW)	Assistant Secretary of Army for Civil Works
ASHPO	Alaska State Historic Preservation Office
ASRC	Arctic Slope Regional Corporation
BCR	Benefit-to-Cost Ratio
BLM	Bureau of Land Management
C	Vertical Clearance
CEQ	Council on Environmental Quality
CHL	Coastal & Hydraulics Laboratory of ERDC
CI	Cumulative Impacts
COE	U.S. Army Corps of Engineers
CSB	Concentrate Storage Building
DA	Department of Army
DI	Department of Interior
DMT	Delong Mountain Terminal
DMTS	Delong Mountain Transportation System
dwt	dead weight ton
EIS	Environmental Impact Statement
EPA	Environmental Protection Agency
ER	Engineering Regulation
ERDC	Engineering & Development Center, Vicksburg, MS
FEL	Front End Loader
FCSA	Feasibility Cost Sharing Agreement
fpm	feet per minute
ft	foot or feet

GNF	General Navigation Features
gpm	gallons per minute
H	horizontal
h	hour
HQUSACE	Headquarters, US Army Corps of Engineers, Washington, D.C.
IDC	Interest During Construction
IFR	Interim Feasibility Report
IFS	Interim Feasibility Study
IRA	Indian Reorganization Act
IWR	Institute for Water Resources, Ft. Belvoir, VA
knots	nautical miles per hour
kW	kilowatt
LER	Lands, Easements, Rights-of-Way
LERR	Lands, Easements, Rights-of-Way, and Relocations
LOA	Length Overall (of a vessel)
LPP	Locally Preferred Plan
LSF	Local Service Facilities
m	meter
MLLW	Mean Lower Low Water
m/s	meters per second
Mw	megawatt
NAAQS	National Ambient Air Quality Standards
NANA	Northwest Alaska Native Association
NED	National Economic Development
NEPA	National Environmental Policy Act
NMFS	National Marine Fisheries Service
NPDES	National Pollutant Discharge Elimination System
NOAA	National Oceanic & Atmospheric Administration
NOS	National Ocean Survey
NPS	National Park Service
NSB	North Slope Borough, Barrow, AK
NWAB	Northwest Arctic Borough, Kotzebue, AK
ODMDS	Ocean Dredged Material Disposal Site
OMRR&R	Operation, Maintenance, Repair, Replacement & Rehabilitation
PDT	Project Delivery Team
PL	Public Law
PMP	Project Management Plan
POA	Pacific Ocean Division-Alaska District, Anchorage, AK
POD	Pacific Ocean Division-Headquarters, Ft. Shafter, HI
PSP	Project Study Plan
ROD	Record of Decision
RODFEM	Required Overdepth Dredging for Efficient Maintenance
SPM	Shore Protection Manual (Corps of Engineers)
swt	short wet ton

t	short ton
TCAK	Teck Cominco Alaska
TIC	Total Investment Cost
tph	tons per hour
USCG	United States Coast Guard
USFWS	U.S. Fish and Wildlife Service
v	vertical
VLCC	Very Large Crude Carrier
w	Width
yd	Yard
ZSF	Zone of Siting Feasibility

1.0 INTRODUCTION

1.1. Purpose of Report

This draft Interim Feasibility Report (draft IFR) and accompanying draft Environmental Impact Statement (draft EIS) was developed to report on the studies conducted and the conclusions reached for the Corps of Engineers to tentatively recommend navigation improvements for the DeLong Mountain Terminal (DMT) in northwestern arctic Alaska on the Chukchi Sea. The tentatively recommended plan, Alternative 11, includes: a deep-draft navigation channel with turning basin and berthing area; an offshore dock with base metal concentrate shiploading and fuel offloading capability; a trestle to shore carrying an enclosed concentrate conveyor, fuel pipeline, and truck access road; and associated ancillary shoreside structures and facilities.

The draft IFR is divided into seven sections and seven appendixes as summarized in the following paragraphs.

Introduction - Provides background information on the study, authority, process, and participants.

Existing Study Area Conditions - Identifies the existing DMT facilities along with the existing climate, weather, storm, mining, transportation, shipping, economic, environmental, cultural, and subsistence conditions in the area.

Plan Formulation - Discusses problems and opportunities associated with the existing operation of the DMT, without-project condition, planning objectives and evaluation criteria. Identifies navigation measures to potentially improve the DMT operation. Provides the Phase 1 Formulation, taking measures and screening and combining them to form alternatives. Describes these alternatives, comparing and evaluating them, and performing Phase 2 Formulation, screening them down to a short list of detailed alternatives.

Comparison of Alternatives and Selection of Plans - Compares and evaluates the four detailed alternatives in Phase 3 Formulation to determine the tentatively recommended plan.

Tentatively Recommended Plan - Provides additional more detailed information on the plan, particularly as regards the federal and non-federal responsibilities for implementing the tentatively recommended plan.

Report Review - Summarizes the report review process to date, identifies reviewers' significant comments and concerns, and summarizes evaluation of significant concerns.

Appendix A, Hydraulic Design - Provides the technical and engineering details supporting the development of alternatives and the tentatively recommended plan.

Appendix B, Geotechnical - Presents basic geotechnical information for the existing DMT site and proposed dredging and disposal areas.

Appendix C, Cost Estimate - Provides the detailed cost estimated for the tentatively recommended plan.

Appendix D, Real Estate Plan - Identifies the real estate interests necessary to obtain prior to construction of the tentatively recommended plan.

Appendix E, Economic Analysis - Presents a detailed evaluation of current economic and social conditions for the Red Dog Mine, the DMT, and communities in western and northern arctic Alaska. Evaluates the base metal concentrate export and fuel delivery systems in the area and identifies problems and opportunities for improvement. Develops the costs and the National Economic Development (NED) benefits for the alternatives, compares and evaluates the economics of the alternatives, including a sensitivity analysis of 12 potentially significant parameters, and provides the support for the selection of the tentatively recommended plan.

Appendix F, Ship Simulation Model - Discusses the dynamic simulation model used in the determination of potential economic benefits resulting from the proposed DMT navigation improvements.

Appendix G, Correspondence - Includes copies of significant correspondence received/sent as part of the study and report development.

1.2. Purpose of Section 1

The purpose of this section of the draft IFR is to provide background information on study authority, study purpose, and study participants, including the cooperating agencies. Pertinent prior reports by the Corps and others are listed and the overall planning process and plan formulation approach described. Public involvement activities are summarized.

1.3. Study Origin

At the request of the local sponsor, the Alaska Industrial Development and Export Authority (AIDEA), the U.S. Army Corps of Engineers (COE) conducted an expedited reconnaissance study in 1999 to determine if a Federal interest existed in a detailed study of possible improvement of the navigation facilities portion of the DeLong Mountain Regional Transportation System (DMTS), located in Northwest Alaska on the Chukchi Sea. AIDEA believed the existing navigation system and port configuration, referred to as Delong Mountain Terminal (DMT) in these documents, needed modification to be capable of meeting the needs of the primary user of the DMT. The expedited reconnaissance study concluded that a Federal interest existed in a feasibility study of navigation improvements for DMT. The Section 905(b) Analysis was completed on 9 November 1999. Headquarters of the U.S. Army Corps of Engineers (HQUSACE) approved proceeding into the feasibility phase of planning on 14 December 1999.

The Feasibility Cost Sharing Agreement (FCSA) between AIDEA and the Corps for the DeLong Interim Feasibility Study (IFS) was signed on 20 January 2000. Work on feasibility phase work items began immediately in accordance with the Project Study Plan (PSP), dated January 2000, which has been amended thrice. This draft Interim Feasibility Report (draft IFR) documents the methods and findings of studies aimed to address navigation and port improvements. Appendixes for the draft IFR and the draft Environmental Impact Statement (draft EIS) and its appendixes provide additional information.

1.4. Study Authority

The authority for the DeLong Mountain Terminal Navigation Improvements IFS is provided by the "Rivers and Harbors in Alaska" study resolution adopted by the U.S. House of Representatives Committee on Public Works on December 2, 1970, which reads in part:

> *Resolved by the Committee on Public Works of the House of Representatives, United States, that the Board of Engineers for Rivers and Harbors is hereby requested to review the reports of the Chief of Engineers on Rivers and Harbors in Alaska, published as House Document Numbered 414, 83rd Congress, 2nd Session; ...northwestern Alaska, published as House Document Numbered 99, 86th Congress, 1st Session; ...and other pertinent reports, with a view to determining whether any modifications of the recommendations contained therein are advisable at the present time.*

1.5. Study Purpose

The purpose of this IFS is to investigate Northwest Alaska's marine freight needs and determine whether a federal interest exists for federal financial participation in the future development of navigation improvements in or near DMT, providing an interim and not final response to the study authority. The main purpose in improving the existing barge lightering operation at DMT is to increase efficiency and achieve cost savings while providing for greater future capability for transporting base metal concentrate, fuel, and general cargo goods. The draft IFR and draft EIS identify the National Economic Development (NED) plan as well as other alternatives. The draft IFR/EIS tentatively recommends a plan for construction and provides the U.S. Congress a complete decision making document for authorizing implementation of a project. The draft IFR/EIS also serves as the foundation for developing further design analyses, and plans and specifications for project construction.

1.6. Scope Of Feasibility Study

The DeLong Mountain Terminal Navigation Improvements IFS is a pre-authorization study being conducted by the Alaska District, U.S. Army Corps of Engineers and AIDEA. They are reviewing previously completed studies, using current information, analyses, planning criteria, and policies. Results of the study are documented in this IFR.

The study involved consideration and analysis of many technical areas including the following:

- Survey and Mapping
- Hydrology and Hydraulics
- Engineering Design
- Geotechnical Studies
- Economic Analysis
- Institutional Studies
- Real Estate Studies
- Environmental Studies

- Cultural Resources Studies
- Cost Estimating

The scopes of these technical studies were summarized in the original Project Study Plan, which when revised, became the Project Management Plan (PMP) for the study, as amended and revised, and are not restated here. However, the results of these studies are summarized in this draft IFR and draft EIS and presented in detail in the respective technical appendixes of this draft IFR or the draft EIS, as appropriate.

1.7. Study Sponsorship and Participants

The local sponsor for this study is AIDEA, the Alaska State Agency that owns the DMT facilities. As part of their required contributions to the study, they have provided cash and a substantial amount of in-kind engineering and environmental services through a group of consultants. Personnel from the Alaska District, and the local sponsor, AIDEA, were the primary participants in the study. Other Project Delivery Team (PDT) members included personnel from other offices of the Corps, other federal agencies, and a number of consultants. Assisting the Alaska District directly was the Corps' Coastal and Hydraulic Laboratory in Vicksburg, MS, the Corps' Center of Expertise for Cost Estimating in the Walla Walla, WA District, the Institute for Water Resources at Ft. Belvoir, VA, the National Marine Fisheries Service, and the U.S. Fish and Wildlife Service. Corps contractors included Oceanweather, Inc. of Cos Cob, CT, Consulting Economist, Inc. of Beaverton, OR, Greenridge Services, Inc. of Santa Barbara, CA, Tetra Tech, Inc. of Seattle, WA, and Tryck, Nyman, and Hayes of Anchorage, AK. AIDEA, Teck Cominco, and Teck Cominco Alaska (TCAK) participated on the PDT along with a number of their consultants. These included AMEC (formerly AGRA Simons and H.A. Simons, Ltd.) of Vancouver, BC; Peratrovich, Nottingham & Drage of Anchorage AK; Triton Consultants of Vancouver, BC; Westmar Consultants of North Vancouver, BC; Golder Associates, Burnaby, BC; Peter Hatfield of Vancouver, BC; Pfitzco of Tampa, FL; and RWJ Consultants of Anchorage, AK. The Independent Technical Review Team for this IFS included personnel from Seattle, Portland, and Alaska districts, the Northwestern Division in Portland, OR, and contractor personnel from Tetra Tech, Inc. in Washington, DC and Gulf Engineers and Consultants, Inc. of VA.

1.8. Cooperating Agencies

By letter, dated 14 March 2000, the Corps invited the Environmental Protection Agency (EPA) to become a cooperating agency for the DeLong EIS because the possibility that a project might involve ocean disposal of dredged materials for which the EPA/COE would need to select a Section 102(c) and/or designate a Section 103(b) Ocean Disposal Site. Under the Marine Protection, Research and Sanctuaries Act of 1972, EPA administers the overall Federal program for disposal of dredged material into ocean waters. EPA also was the lead agency for the preparation of the original Red Dog Mine EIS. By letter, dated 19 March 2001, the EPA agreed to terms to be a cooperating agency for the DeLong EIS. EPA has cooperated with the Corps in developing the Ocean Dredged Material Disposal Site (ODMDS) Appendix and the Cumulative Impacts (CI) Analysis for the draft EIS.

By letter dated 10 May 2000, the National Park Service (NPS) requested participation as a cooperating agency because: Their agency has specific expertise regarding Cape Krusenstern

National Monument resources (through which the DMTS road passes), they are a land manager of a conservation system unit adjacent to the project area, and they are a party to the NANA-U.S. Government Land Exchange and Road Lease agreement that facilitated development and operation of the Red Dog Mine. NPS has cooperated by participation in coordination and reviewing work products as they have been developed.

Following extensive policy discussions with HQUSACE, the Alaska District on 7August 2002 agreed to discuss a cooperating agency agreement with Kivalina IRA Council and the other recognized IRA Councils of Point Hope, Noatak, and Kotzebue. The scope of cooperating agency responsibilities was discussed with the Kivalina IRA Council, but a mutually acceptable scope of work agreement has not been reached at the time of this draft report.

By letters dated 22 December 2004 and 12 January 2005, the Northwest Arctic Borough (NWAB) requested participation as a cooperating agency because: it is the regional government representing the local communities that would be most impacted by navigation improvements at DMT and will be responsible for processing local permits required for any project.

1.9. Previous Corps and Related Reports

The Corps of Engineers has prepared reports in the past pertaining to deep-draft navigation in and through the Chukchi Sea. None of these past reports recommended navigation improvements by the Corps of Engineers for Portsite. In recent years, the Corps and others have produced reports on the relocation of the Village of Kivalina. In addition, other state and Federal agencies and private firms have produced reports that have considered possible means and costs for resource and public transportation in the northwest arctic. The most significant or pertinent past reports are summarized in table 1.

Table 1. Corps and Related Reports Regarding Northwestern Alaska Deep-Draft Navigation

1957	The Alaska District completed a report on northwestern Alaska in June 1957 concluding that no navigation, flood control, or power improvements were economically justified at that time, but further study was warranted for a Port Clarence deep water transshipment port and for hydroelectric development on the Seward Peninsula, the Noatak, and the Colville Rivers.
1980	In 1980 Lewis Berger & Associates prepared a report for the Alaska Department of Transportation and Public Facilities (ADT&PF) to assess transportation and public facility needs of the area.
1982	In June 1982, Cominco Engineering Services Ltd. completed a report that considered the various options available for configuration of the elements of a Red Dog Mine project, including docking facilities, handling systems, and transport options.
1984	In 1984, the EIS for the Red Dog Mine Project was completed by the EPA and the Department of Interior (NPS, BLM, and USFWS), with the Corps as a cooperating agency. The EIS evaluated alternatives and identified expected impacts. The EIS selected a mine and mill configuration, a route for the road to Portsite, and configuration of port facilities at VABM 28.
1985–1988	Arctic Slope Consulting Engineers completed reports in October 1985 and April 1988 that evaluated the feasibility of the Western Arctic Coal Development Project.
1988	In September 1988 the Alaska District concluded a Preliminary Assessment of the need for new or expanded harbor improvements to accommodate mineral development. Further studies were identified as appropriate for Kivalina, Kotzebue, Port Clarence, Nome, Bethel, Point MacKenzie, Iliamna Bay, Granite Point, North Foreland, Herendeen Bay, and Balboa Bay.
1989	In October 1989 the Portland District completed a study of transportation infrastructure development for moving natural resources and general cargo at Kivalina, Nome, Unalaska, and Port MacKenzie. None of the four navigation improvement alternatives, considered for Kivalina (Portsite), appeared economically justified with exports limited to 750,000 swt of concentrate annually. Servicing oil and gas exploration out of Portsite was unlikely due to the absence of a Portsite airstrip. Movement of general cargo was unlikely due to lack of a road from Portsite to Kivalina.
1990	Reports were completed in 1990 by the U.S. Bureau of Mines examining the potential mineral development near the port sites of Bethel, Kivalina (Red Dog), Omalik Lagoon, Iliamna Bay, Kotzebue, and Nome.
1992	In 1992 CH2M Hill completed a report for AIDEA on northwestern Alaska Resource Development Transportation Alternatives for alternative coal transportation systems.
1993–1994	In 1993 CH2M Hill completed Phase I, and in 1994, Phase II of the DeLong Mountains Transportation System Additional Use Study. The purpose of the study was to investigate additional uses for the DMTS.
1994	DOWL Engineers completed in December 1994 a report on relocation options available for the village of Kivalina. The study identified Kuugrauq (about 3 miles east of the existing site on the Wulik River) as the best site with Igrugaivik (about 2 miles east on Igrugaivik Creek) as second best.
1995	In June 1995 the Alaska District completed the Northern Sea Route Reconnaissance Report, which identified needs for port improvements to facilitate shipping by the Northern Sea Route, extending from the Atlantic Ocean to the Pacific Ocean along the northern coast of the Russian Federation. Further studies were recommended for Dutch Harbor/Unalaska.
1997	In December 1997 the Alaska District completed a report based on a draft by Tryck Nyman Hayes that evaluated marine navigation needs of all coastal communities in western and northern Alaska to identify projects that could have a Federal interest. Fifteen communities were found to have potential Federal projects, but only five were interested in participating in cost-shared project studies. Kivalina did not support further studies of improvements.
1997	H.A. Simons Ltd. completed a study in December 1997 for Cominco that reviewed then current operations, evaluated alternatives, and identified a “best” alternative to be a 2,500-foot-long trestle, extending out to the 30-foot depth contour, and a 50-foot deep channel, dredged from deep water to a loading facility on the end of the trestle.
1998	Alaska District in April 1998 completed a Community Improvement Feasibility Report for Kivalina. Based on information developed in the study, in February 1998 Kivalina residents selected, as preferred, the Igrugaivik site on the Wulik River.
1999	In February 1999 Northern Economics completed a report for Cominco and AIDEA that evaluated potential costs and benefits of navigation improvements at Portsite.
1999	In August 1999 H.A. Simons completed a report for Cominco that compared variations of the trestle-channel proposal from the 1997 study, and prepared design and cost estimates.
2001	In December 2001 Trick Nyman Hayes completed a report for the Alaska District that provided the Kivalina Relocation Community Layout Plan. The Kiniktuuraq site (about 2 miles southeast on Igrugaivik Creek was selected by the community.
2002	In February 2002 CH2M Hill completed for ADT&PF Phase I of the Northwest Alaska Transportation Plan. Plan work was divided into Community Transportation Analysis (CTA) and Resource Transportation Analysis (RTA). Phase I of

	CTA identified potential improvements for better movement of residents and their goods between local villages to be considered in detail in Phase II. Phase I of RTA identified four resource transportation corridors for further consideration in Phase II. These included: moving western arctic coal to Portsite and Ambler District minerals to the Dalton Highway, access from Prudoe Bay to Nuiqsut, and joining Yukon River ports with a phased road network. RTA Phase II should be completed in 2005.
2004	In February 2004 Phase II of the CTA of the Northwest Alaska Transportation Plan was completed and recommended further work on a number of transport ation improvements for the villages. These included: marking winter trails in the Seward Peninsula/Norton Sound area, the NWAB, and the NSB; providing improvements for 50 village airports; making barge navigation improvements at 14 villages; and adding local roads for villages to access nearby materials sources, boat and barge landings; and community evacuation roads.

1.10. Planning Process

The Corps of Engineers planning process is based on the *Economic and Environmental Principles and Guidelines for Water and Related Land Resources Implementation Studies* (P&G) established by the Water Resources Council in 1983 and other laws and regulations applicable to the Corps Civil Works Program. Plans recommended for implementation, in general, are required to reasonably maximize net national benefits. The Federal objective is to contribute to the national economic development consistent with protecting the Nation's environment, in accordance with national environmental statues, applicable executive orders, and other Federal planning requirements. The Corps Planning Process follows the six-step process defined in the P&G. The process is a structured approach to problem solving, which provides a rational framework for sound decision-making.

The six steps are the following:

Step 1 – Identify Problems and Opportunities

Step 2 – Inventory and Forecast Conditions

Step 3 – Formulate Alternative Plans

Step 4 – Evaluate Alternative Plans

Step 5 – Compare Alternative Plans

Step 6 – Select a Recommended Plan

The planning process is iterative by nature, with a given study performing the steps multiple times until a decision is reached. The steps give a sense of order to the planning process, but the process really is focused on balance and is not rigid at all. For any given study, a number of iterations are usually required. An iteration can start with any step. Each step is performed at least once, but not necessarily in the listed order. Although the formulation was done in an iterative manner, going through the six steps a number of times, this report presents formulation as a three-phase effort, following a logical not a chronological format.

1.11. Plan Formulation Overview

For this IFS, a range of alternative measures were identified and evaluated, alternatives developed, compared and evaluated, and finally, plans designated with one tentatively selected for recommendation. This formulation and evaluation process was conducted in three phases.

Phase 1 concentrated on steps 1 and 2 of the planning process. The existing conditions in the Portsite area are identified in Section 2 of the draft IFR. Then, in Section 3, the water resources problems and opportunities are identified, inventoried, and forecasted, and a without-project condition determined. Planning objectives are determined and constraints identified. Possible measures to achieve the planning objectives are developed, compared, and evaluated, and the most promising measures are combined into a preliminary set of alternatives. For the study, about 80 possible ways to move concentrate were screened down to 15. Sixteen fuel measures were screened down to 8. These preliminary measures were screened primarily by their capacity to address the planning objectives and potentially meet the evaluation criteria. The 24 remaining measures were initially combined to form 12 alternatives.

Phase 2 concentrated on steps 3 and 4 of the planning process. Alternatives are developed and evaluated by appropriate criteria and compared with each other. Those alternatives that do not meet the planning objectives or clearly fail evaluation criteria are screened out, leading to a group of alternatives to be considered in detail. The preliminary set of 12 alternatives was evaluated and screened based upon their capacity to address the planning objectives and potentially meet the evaluation criteria. This list of 12 alternatives was screened down to four alternatives for consideration as "detailed alternatives" in the draft IFR. This process is discussed in Section 3 of the draft IFR.

Phase 3 concentrated on steps 5 and 6 of the planning process. The four detailed alternatives were evaluated using the planning objectives and the evaluation criteria. Where appropriate, alternatives were refined and variations optimized to identify the scope and scale of the alternative that would likely provide the maximum net NED benefits. This analysis identified the NED Plan and supported selection of the tentatively recommended plan. This part of the planning process is discussed in Section 4 of the draft IFR.

1.12. Environmental Operating Principles

The U.S. Army Corps of Engineers has reaffirmed its commitment to the environment by formalizing a set of "Environmental Operating Principles," announced on 26 March 2002 applicable to all its decision-making and programs. These principles foster unity of purpose on environmental issues, reflect a direction for dialogue on environmental matters, and ensure that conservation and environmental preservation and restoration are considered in all Corps' activities. The principles are consistent with the National Environmental Policy Act, the Army's Environmental Strategy with its four points of emphasis of prevention, compliance, restoration, and conservation, and other environmental statutes, including Water Resources Development Acts that govern Corps' activities.

The Corps Environmental Operating Principles include the following:

- Strive to achieve environmental sustainability.
- Recognize the interdependence of life and the physical environment.
- Seek balance and synergy among human development activities and natural systems by designing economic and environmental solutions that support and reinforce one another.

- Continue to accept corporate responsibility and accountability under the law for activities and decisions under our control that impact human health and welfare, and the continued viability of natural systems.
- Seek ways and means to assess and mitigate cumulative impacts to the environment.
- Build and share an integrated scientific, economic, and social knowledge base that supports a greater understanding of the environment and impacts of our work.
- Respect the views of individuals and groups interested in Corps' activities, listen to them actively, and learn from their perspective in the search to find innovative win-win solutions to the Nation's problems that also protect and enhance the environment.

1.13. Public Involvement and Scoping Meetings

Public involvement activities were related to developing public information on the study and obtaining public comments during the study process. The public involvement strategy consisted of (1) an initial study scoping meeting; (2) periodic study team meetings open to the public, news releases, and information pamphlets; and (3) speaking engagements at local organizations by Corps and AIDEA personnel. The study included review throughout the process by agencies at the federal, state, local and Tribal government level, special interest groups, and the general public.

A Notice of Intent (NOI) to prepare an EIS on navigation improvements at Portsite and announcement of public scoping meetings appeared in Federal Register Volume 65, Number 48, on 10 March 2000. A meeting notice describing the project, requesting comments, and announcing the dates, times, and locations of the public scoping meetings was mailed to interested individuals, groups, agencies, and tribes. A press release announcing the public meetings was sent to local media.

The Corps held five public scoping meetings on 27, 28, and 29 March 2000 at Noatak, Kotzebue, and Kivalina, respectively, 24 May 2000 at Point Hope, and 19 July 2000 at Kivalina, all located in northwestern arctic Alaska. At these meetings the Corps listened to the interested individuals who attended and the concerns they had regarding further development at Portsite, the studies that should be done, and the questions that should be answered.

The primary concern expressed centered on potential alternative impacts to the natural resources of the area and any subsequent impact to continued subsistence harvesting of those resources by residents. The marine biological resources identified as being of particular concern were: bearded seal, beluga whale, bowhead whale, ringed seal, char, salmon, shrimp, crab, plankton, and the other organisms that are important in the food chain. During the study, concerns were also expressed over the economic feasibility of a project, the need to consider non-structural measures, risk and uncertainty, environmental justice, cumulative impacts, and endangered species coordination.

Possible alternative impacts to these resources that were suggested included (1) noise and presence from shipping, loading, tug operations, land activities, maintenance activities, and aircraft at the site; (2) dredging noise, turbidity, contaminant release, activity, and habitat modification or destruction, and dredged material disposal effects on marine life and habitat; (3) effects on marine processes and organisms (such as, shadow and presence effects on mammal and fish movement, piling effects on ice movement and development of leads, dredged channel effects on local currents, water movement, littoral drift, long-shore transport, shoreline erosion, and movement of fish, marine mammals, and other organisms).

Concerns were also expressed about regional mining development that could adversely affect the ability of residents to get to and harvest subsistence plants and animals, adversely impact plants and animals important to the ecosystem and subsistence, and that could lead to changes in traditional lifestyle, erosion of values, and undesirable change. The initial construction and continued operation of the Red Dog Mine, the DMTS, and DMT were perceived by some residents to already have significantly adversely affected the environment and the ability of residents to perform their subsistence activities. A key concern of Native residents is that further development will have an adverse impact on subsistence areas, species, and lifestyles. However, some recognized that today’s youth would probably never go all the way back to the old days of dog mushing and paddling for sea mammals. Today, residents use fast boats, snow machines, ATV’s, and need to have guns, ammunition, fuel, etc. to hunt and fish. The jobs provided by the Red Dog Mine do provide cash income for northwest arctic residents to continue their traditional subsistence activities in the future.

The PDT considered the concerns expressed by the public regarding potential Portsite improvements as the study plan was developed and revised. Care was taken to consider in depth those items of particular concern to local residents. The study also facilitated discussions between villages and TCAK regarding the current operation of the Red Dog Mine, DMTS, and DMT.

2.0 EXISTING STUDY AREA CONDITIONS

2.1. Purpose of Section 2

The purpose of this section of the draft IFR is to provide the reader with a written and visual picture of the existing concentrate movement facilities at the DMT and the economic, social, environmental, and cultural conditions in western and northern Alaska. Hydrologic and hydraulic conditions experienced at DMT are described, along with geotechnical foundation and seismic studies, sediment transport estimates, and sound generation activities. The economic and environmental study areas for the report are defined. Governmental, economic, and social conditions are summarized. The biological, cultural, and subsistence resources near Portsite are presented.

2.2. Study Area

The primary study area for navigation improvements is near Portsite on the shore of the remote Chukchi Sea in northwestern arctic Alaska, about 650 miles northwest of Anchorage. Figure 1 superimposes a map of Alaska over that of the contiguous 48 states at a common scale. The study area is as far from Anchorage, the largest city in Alaska, as Jacksonville, Florida is from Washington, D.C. The name “Portsite” was locally generated as a convenient way to refer to the site with its port facilities for exporting base metal concentrates from the Red Dog Mine. The name is not recognized by Federal mapping agencies and typically does not appear on regional maps. Portsite is only an industrial area and is not an incorporated community. There are no permanent residents. The people living at Portsite are employed in mining, milling, or shipping activities, generally on bi-weekly rotational shifts. The Red Dog Mine is linked to Portsite with 52 miles of road. Figure 2 shows the relationship of Portsite to the mine, to nearby communities in northwestern arctic Alaska, and to Russia.

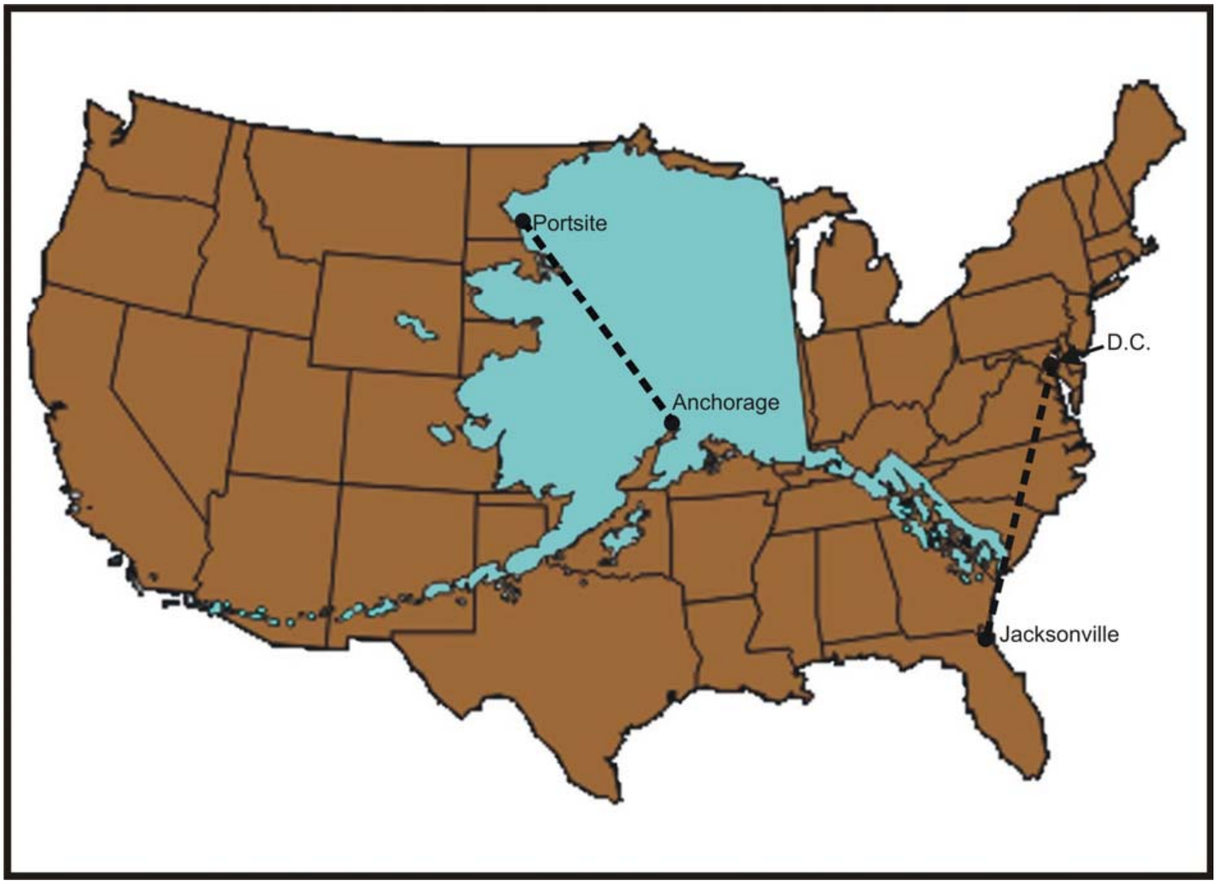

Figure 1. Alaska Superimposed Over the Continental United States

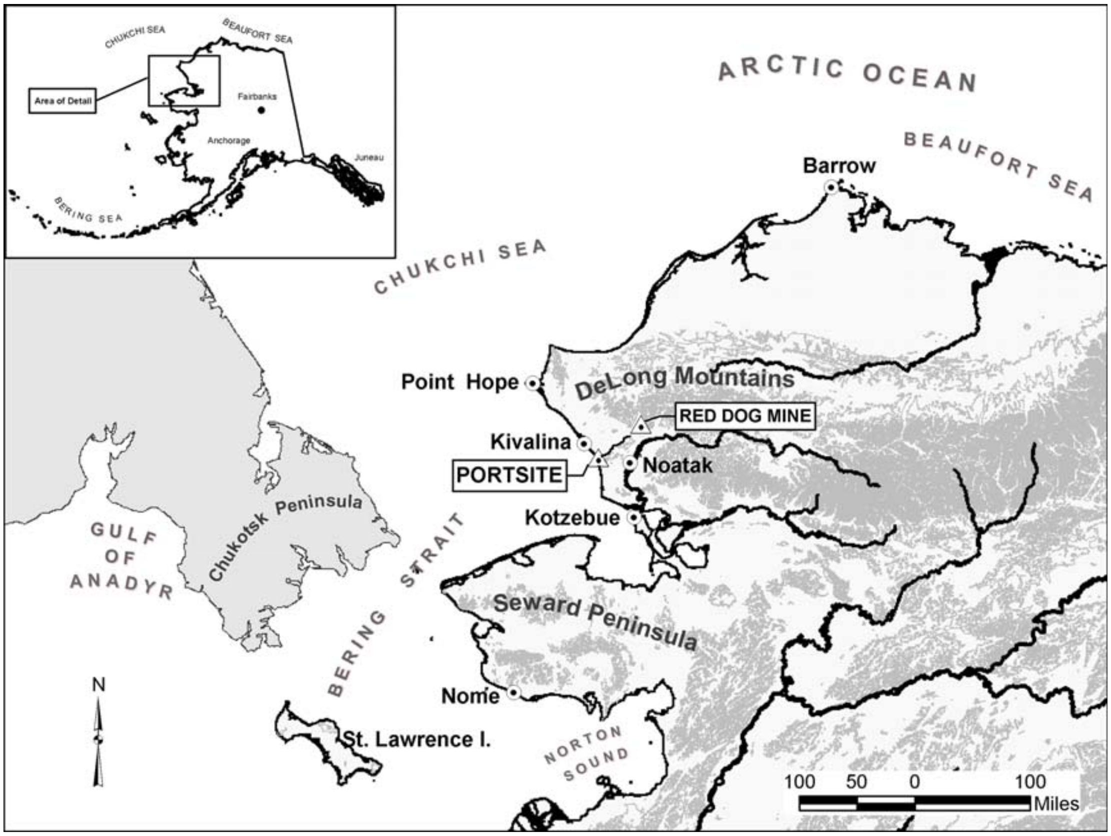

Figure 2. Portsite Location Map

2.3. Existing Conditions

The existing condition is defined as those conditions that exist at the time of the study. AIDEA currently owns the existing DMTS, which is infrastructure consisting of the road from the Red Dog Mine to Portsite and the Portsite shipping facilities. The Portsite shipping and receiving facilities are generally known as the DeLong Mountain Terminal (DMT). Red Dog Mine, the world's richest and most productive zinc mine, is on land owned by NANA Corporation about 52 miles northeast of Portsite. Teck Cominco Alaska (TCAK) owns and operates the mine and mill infrastructure under a development agreement with NANA. Figure 3 shows the current Red Dog Mine main pit in the middle of the picture, with the mill and personnel complex to the right. The tailings pond is above and to the left of the mill. Currently TCAK operates the Red Dog Mine and mill 12 months of the year. The Red Dog Mine is an open pit operation, producing zinc and lead concentrates. Ore is mined, crushed, ground, and processed in the mill. Tailings from the mill are pumped to the nearby tailings pond. The mill complex is fully self-contained, with living quarters, offices, and maintenance facilities. It is considered a fly-in operation, with a dedicated airstrip located just southeast of the tailings pond. Mineral concentrate produced at the Red Dog mill is dewatered and stored in a small concentrate storage building at the mine. A fleet of bulk transport, tractor-trailer units move the zinc and lead concentrates to Portsite in tandem self-dumping trailers with steel covers (figure 4).

Figure 3. Aerial view of Red Dog Mine

The road is on land owned by NANA under long-term lease to AIDEA, and by the state of Alaska. On Federal lands within Cape Krusenstern National Monument, the road is within a Congressionally designated, 100-year easement. NANA also owns the land at and around Portsite. TCAK operates the DMTS under a priority, non-exclusive agreement with AIDEA. TCAK currently transports zinc and lead concentrate from the mine to Portsite for transshipment to its smelter in Trail, British Columbia and to smelters in Asia and Europe owned by other companies. Portsite facilities handle import of fuel, equipment, and consumables for the TCAK operations. Portsite facilities include: (figure 5) the concentrate storage buildings, a fuel tank farm, a lightering barge loading facility with fuel barge offloading capability, a shallow-water barge dock, materials conveyors linking the various facilities, and ancillary support facilities.

2.3.1. Portsite Operations

The complete Portsite industrial facility comprises the following elements:

- The open-sea anchorage for vessels as large as Panamax-class bulk carriers (up to 75,000 dead weight tons (dwt)) is located 3 to 5 miles offshore in water depths of 50 to 72 feet.
- Two, 5,500 dwt, self-discharging, lightering barges (Kivalina and Noatak) are operated in conjunction with four tugs (figure 6). In normal operations, one tug is with each barge, and the third tug pulls the stern of the ship being loaded to create a lee along the side of

the ship for offloading the lightering barges. The fourth tug is used as a helper to move barges on and off the ship, on and off the berths, and for crew support.

Figure 4. Concentrate Transport Truck and Trailers

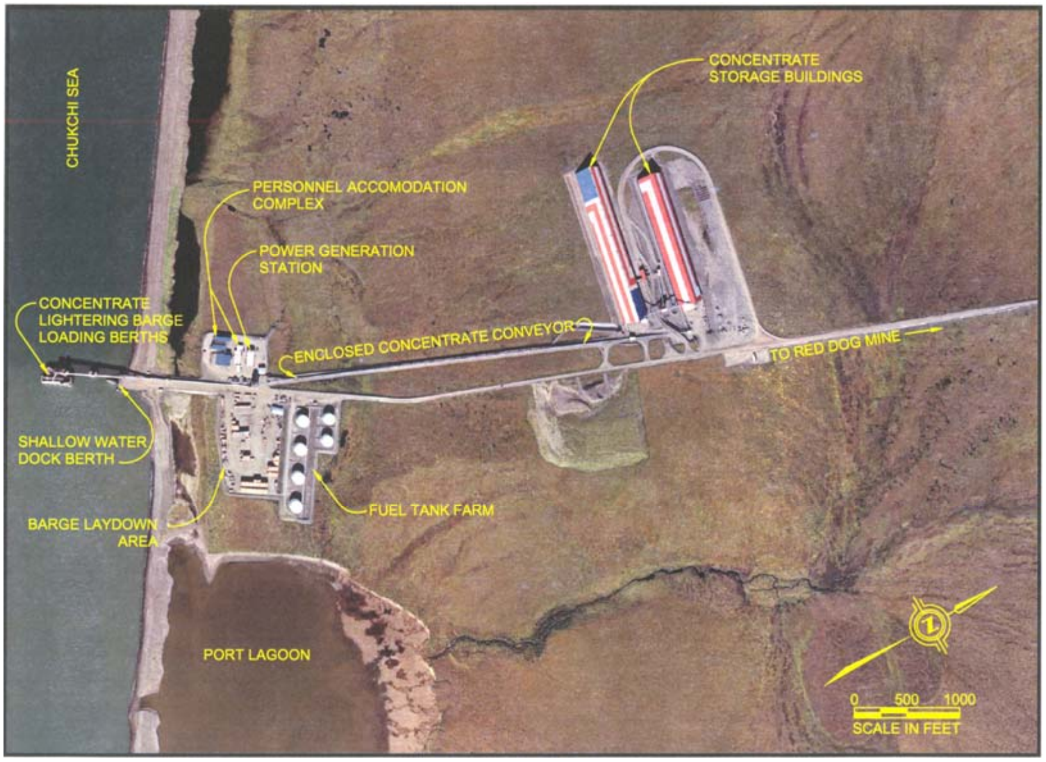

Figure 5. Portsite Facilities

- Seasonal barge moorings, consisting of single can buoys secured with conventional chain and anchor systems, are located offshore of Portsite. When wind and wave conditions become severe, the barges are moved to the buoys for safety. In rougher conditions, the tugs move the barges out to sea.
- The concentrate barge loading dock has two berths (water depth is approximately 20 feet) for loading the two lightering barges with a single, 2,000 tons-per-hour barge loader (figure 7).
- The enclosed conveyor gallery extends 550 feet from the dock shoreward to the face of the sheetpile shallow water dock. The conveyor gallery and loader are supported on three 74-foot-diameter sheetpile cells (figure 8). The enclosed conveyor gallery extends another 1,230 feet landward from the sheetpile wall to the surge bin near the power generating station.
- The offloading facility for petroleum products, equipped with manifolds (pipeline connection between ship and dock), is on the south side of the first and second sheetpile cells. The manifold transfers fuel through a 12-inch-diameter pipeline directly to onshore storage tanks, located beyond the surge bin. When the fuel barge is berthed, both the south-side concentrate barge berth and the shallow-water dock berth are not usable by other vessels, but concentrate can be loaded on the north concentrate barge berth.
- General cargo is barged to Portsite by NANA/LYNDEN in standard 8,000-ton gross capacity barges (340 feet x78 feet x19 feet) or oversize 9,000-ton barges (300feet x84 feet x19 feet). Most mine operating supply cargo is containerized, consisting of process reagents, grinding balls, and spare parts. Construction cargo is often shipped on

container platforms or as loose stow on top of containers. Normal annual general cargo volume is about 35,000 tons, resulting in four or five tug and cargo barge trips.

- The shallow-water barge dock (water depth is 12 to 15 feet at its seaward face) for general cargo is composed of a sheetpile bulkhead extending about 280 feet from shore (figure 9). Cargo is handled in a RO-RO system using large Catapiller container handlers. In calm weather, the dock is used as a berth by the lightering tugs and for launching small craft, such as the fuel spill response boat.
- Existing upland facilities at the port include two concentrate storage buildings (figures 10 and 11), the materials handling conveyor systems, the fuel tank farm, the powerhouse, the maintenance shops, the personnel accommodations complex, the port office, the construction camp facilities, the sewage treatment plant, roads, and materials storage and borrow areas.

Due to the severe ice conditions, the port is ice-free only 3 to 5 months each year. The shipping season generally begins in early to mid-July, when the ice has left, and the Native subsistence hunting period has ended. Under current conditions, the concentrate vessels anchor outside the 3-mile U.S. territorial limit, and thus Customs, Immigration, and U.S. Coast Guard officials are not required on a regular basis to visit and inspect the vessels and crew. The trucked concentrate is stockpiled in the two concentrate storage buildings at Portsite. Current building capacity is 1,038,000 short wet tons (swt—when referring to mineral concentrates, short wet tons refers to actual shipping weight, which includes contained moisture.). The concentrate is stored until the short, summer shipping season. The existing barge lightering system is operated near capacity, except for equipment and weather delays, 24 hours a day from the start of shipping until the two concentrate storage buildings are empty of concentrate (usually mid-September). For the remainder of each shipping season, the shipping operation is limited by the amount of concentrate that can be produced at the Red Dog Mine and mill, and transported down the road. Usually one or two more shiploads are exported after the concentrate storage buildings are emptied the first time each year.

Figure 6. Concentrate barge loading ship

Figure 7. Concentrate barge loading dock and shallow water dock

Figure 8. Enclosed conveyor gallery

Figure 9. Shallow water dock

Figure 10. Exterior view of concentrate storage buildings

Figure 11. Interior view of concentrate storage buildings

2.3.2. Mine Development

The Red Dog Mine began operation in 1989. It first shipped ore concentrates in 1990. Zinc and lead concentrate production climbed steadily throughout the 1990s (table 2). Mill throughput was significantly expanded with the Production Rate Increase Project in 1997–98. This project increased mill capacity from roughly 800,000 swt per year capacity to 1,400,000 swt per year. The Value Improvement Program (VIP), completed in 2001, further increased mill capacity to 1,544,000 swt per year by eliminating bottlenecks in the production process. Actual throughput capacity in any single year will depend on a number of variables that can shut down shipping such as waves, wind, and ice, limitations of installed equipment, product prices, and production goals.

Table 2. Red Dog Mine Mineral Concentrate Shipments

Year	Concentrate Shipped (swt)	Total Cumulative (swt)
1990	351,807	351,807
1991	604,391	956,198
1992	518,065	1,474,263
1993	511,891	1,986,154
1994	703,726	2,689,880
1995	801,959	3,491,839
1996	951,347	4,443,186
1997	1,087,065	5,530,251
1998	1,071,221	6,601,472
1999	1,327,520	7,928,992
2000	1,260,638	9,189,630
2001	1,339,811	10,529,441
2002	1,502,856	12,032,297
2003	1,496,305	13,528,602
2004	1,505,509	15,034,111

The DeLong Mountain Mining District includes the Red Dog Mine and several other significant mineral deposits. The Red Dog Mine area is the most significant zinc district in the world, with many indications that there is great potential for more discoveries. TCAK holds approximately 370,500 acres of mineral rights in the region. Red Dog Mine has the worlds largest zinc reserve with five deposits grouped together near the mine: the Main Zone, Aqqaluk, Paalaaq, Qanaiyaq (formerly Hilltop), and Anarraaq. The Main Zone deposit is the original pit opened in 1989. The Aqqaluk deposit is near the surface immediately northwest of the main pit, while the Qanaiyaq (formerly Hilltop) deposit is just southwest of the main pit. The Paalaaq deposit is a deep deposit just northwest of Aqqaluk. In 1999, the Anarraaq deposit was identified 6 miles northwest of the main pit at a depth of about 2,000 feet. In 2000, another deep deposit was discovered between Anarraaq and the Red Dog Mine. Table 3 provides a listing of mineral reserves and resources near the Red Dog Mine as reported in the 2000 Cominco Annual Report.

Table 3. Reserves and Resources near Red Dog Mine

Type	Location	Tons
Proven Reserves	Main	41,900,000
Probable Reserves	Aqqaluk	56,100,00
Indicated Resources	Aqqaluk	3,400,000
	Qanaiyaq	9,600,000
Inferred Resources	Aqqaluk	6,800,000
	Paalaaq	13,000,000
	Anarraaq	17,200,000
	(new site)	Unknown
Total		148,000,000

The Red Dog Mine project had, in 2000 by itself, 148 million tons of reserves and resources. Ongoing annual exploration can find more new reserves in a year than are consumed by the mine. For example, in 1999 the remaining reserves and resources were estimated at about 79 million tons, about half of the estimate of the following year following completion of a round of exploration drilling and testing. Not far away from the Red Dog Mine lies another significant deposit—Su Lik, 12 miles northwest, has current reserves of 34 million tons. The amount of reserves in the Red Dog Mine area is constantly changing as new information is discovered and existing reserves consumed. An argument could be made that the estimates of reserves and resources are ultraconservative and that another 40 million tons could be considered as potential additions, if one includes The Alaska Miners Association Railroad Committee’s estimate of other farther away DeLong Mountain’s reserves, classified “Class 1” reserves (those having a greater than 25 percent chance of being developed inside of a decade). Class 1 potential prospects are at Drenchwater, Story Creek, and Kivliktort Mountain. Taken together these deposits are reported to have the potential for production of concentrate volumes of 500,000 to 800,000 tons per year, for 20 to 50 years. The principal known mineral deposits in the DeLong Mountains area, other than Red Dog Mine deposits, are listed in table 4.

Table 4. Mineral Deposits Known to Exist in the General Area of Delong Mountains

Deposit	Mineral Resources
Su-Lik	zinc, lead, silver cadmium
Ginny Creek	zinc, lead, silver
Drenchwater	zinc, lead, silver
Story Creek	zinc, lead, silver, copper, gold
Kivliktort Mountain	Zinc
Alvinella	Zinc
Whoopee Creek2	zinc, lead, copper, silver, gold, cadmium
Avan Hills	Chromite
Misheguk Mountain	Chromite
Nimiuktuk River	Barite

Figure 12 depicts historical Red Dog production from 1990 through 2002 and the expected continued throughput of 1,544,000 swt of base metal concentrate (zinc and lead) through the 2030s. Beyond that, Red Dog is expected to maintain that same level of throughput by developing new discoveries in the nearby area during the next 30 years. This level of throughput is not expected to increase significantly in the foreseeable future due to agreements between AIDEA, TCAK, and NANA. NANA is interested in wisely using its mineral resources to provide a stable "economic engine" for its shareholders in the region. NANA would be expected to resist any effort to significantly increase concentrate production and, consequently, shorten the life of the resources. However, minor increases in throughput might be considered in the future to offset the declining "richness" of the mined ore in an effort to have a stable concentrate volume and value. Concentrate production levels and their effects and impacts are discussed in more detail in Appendix E.

Figure 12 shows previously discussed throughput and some future commodity flows that are uncertain regarding their rate of development and the time at which they might occur. However, given the rich mineral reserves in the northwest arctic and the rate at which the state and regional governments are moving to develop a regional transportation strategy and infrastructure, the projection may turn out to be a conservative view. None of those uncertain developments as currently envisioned are dependent on the Portsite project being implemented, and, in that regard, they are equally uncertain whether or not Portsite is further developed in the near future.

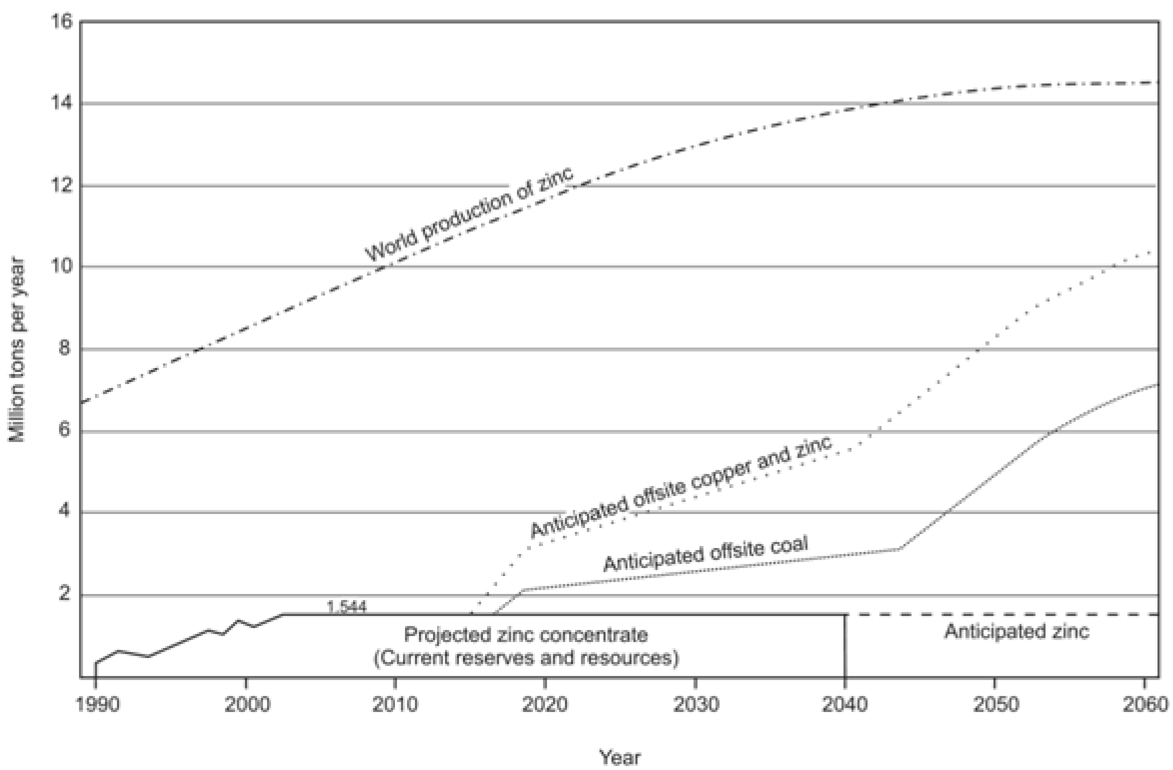

Figure 12. Potential Portsite Shipments

There are approximately 2 billion tons of high rank bituminous coal reserves in the western arctic. To date, the Arctic Slope Regional Corporation (ASRC) has conducted studies on a coal deposit at a site located only 6 miles from tidewater on the Chukchi Sea and about 90 miles north of Red Dog Mine. ASRC has delineated 68 million tons of measured coal reserves available for underground mining, along with an approximate 23 million tons of coal suitable for surface mining peripheral to the underground mine block. Through ongoing drilling, an additional 50 to 100 million tons may become proven for this one deposit. The western arctic coal is of premium quality with an average of 0.23 percent sulfur, 3 percent moisture, 7 percent ash, with a heating value in excess of 12,000 BTU/lb. This coal provides an environmentally friendly alternative to coals presently utilized for power generation. The coal's sulfur dioxide emissions at 0.30 pounds $S0_2$/million BTU (0.54 gm/mega-calorie) are less than 25 percent of the U.S. Environmental Protection Agency's standards. Utilization of western arctic coal for blending during combustion could effectively reduce $S0_2$ emissions, thereby reducing potential future penalties, as Pacific Rim countries move into stricter environmental regulatory enforcement. The economics of bringing this coal to market has not yet been proven. However, ASRC is actively seeking a co-developer to help develop their coalfields. If coal were to be exported from Portsite, a dedicated, additional collier dock would be required along with a road from the coalmine to Red Dog Mine and storage/handling facilities.

2.4. Land Ownership Near Portsite

Land ownership and use in the vicinity of Portsite is shown in figure 13. Construction of the 450-acre DMT facility was completed in 1990, on land owned by the NANA Regional Corporation, and leased for 99 years by AIDEA. All improvements and structures at DMT are owned by AIDEA. An additional 64 acres of tideland are leased from the State of Alaska for the existing DMT. The 52-mile-long DMT road, connecting Portsite to the Red Dog Mine, was constructed in 1988. About one-third of the land occupied by the road is owned by the United States and administered by the National Park Service (NPS), including those portions of the road that pass through Cape Krusenstern National Monument. On September 25, 1985, Congress amended the Alaska Native Claims Settlement Act, 43 USC 1629. This amendment ratified a January 31, 1985 land exchange agreement between the United States and NANA and granted to NANA a 100-year easement across the Cape Krusenstern National Monument. NANA subleased the NPS portions to AIDEA for 99 years. The remaining two-thirds of the haul road is on State of Alaska land from which AIDEA obtained right-of-way. The NANA Regional Corporation owns the mineral rights for the Red Dog Mine. TCAK, the operator of the mine, has a 50-year, non-exclusive, priority usage of the mine, mill, 52 mile-long DMT road and Portsite facilities to transport and ship zinc and lead ore concentrates.

The Bureau of Land Management (BLM) and NANA own land north of Portsite, between Portsite and the Village of Kivalina. The state owns land to the east, northeast, and north of the Cape Krusenstern National Monument, and the marine waters and tidelands to 3 miles offshore. The United States Government claims waters and subtidal lands offshore between 3 miles and 12 miles and the economic zone out to 200 miles. The Cape Krusenstern National Monument is approximately 660,000 acres, lying within the much larger, 2.3-million-acre Cape Krusenstern National Archaeological District, a National Historic Landmark, which was established in 1973 pursuant to the Historic Sites Act of 1935 (Public Law 100-17). The

Cape Krusenstern National Monument was designated a national monument on December 1, 1978. Two years later, December 2, 1980, the boundary was changed to the existing boundary. Local residents use the Cape Krusenstern National Monument mostly for subsistence hunting and gathering, while most visitors use the monument for recreational camping, hiking, and wildlife viewing.

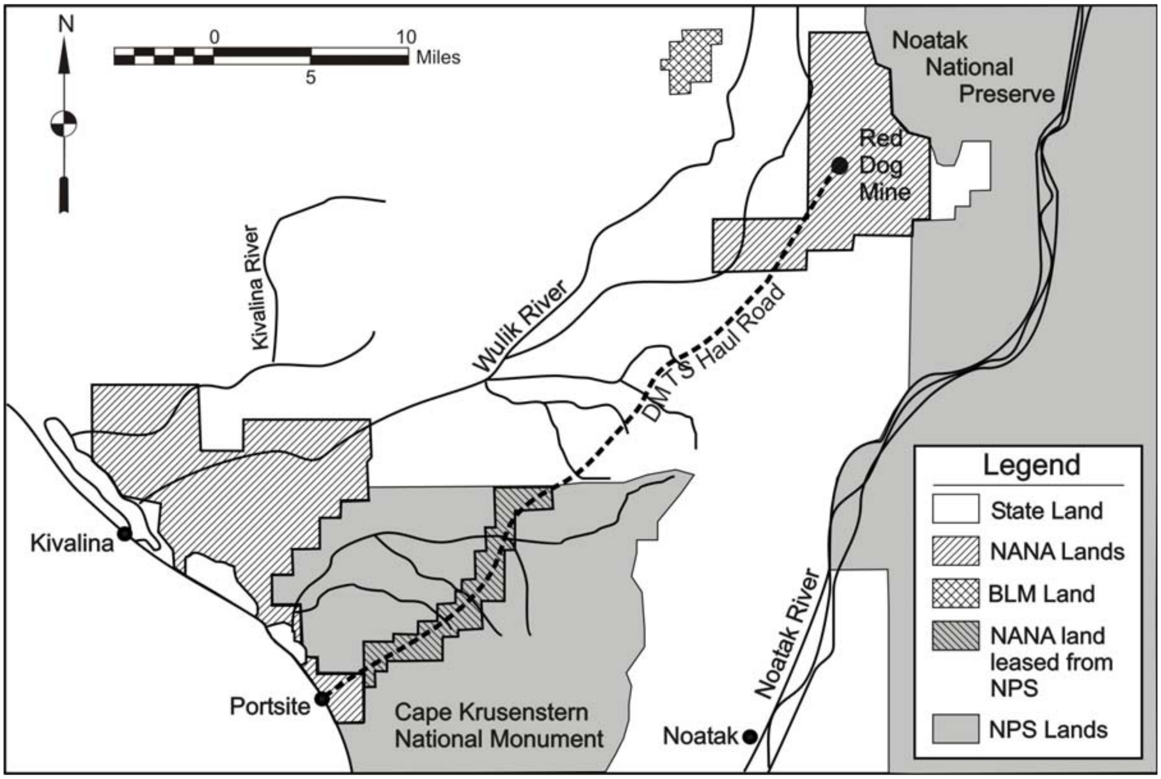

Figure 13. Land Ownership in vicinity of Portsite

2.5. Climate

Portsite lies in the transitional arctic climate zone, which is characterized by long, cold winters and cool summers. The average low temperature at Portsite (short record weather station) during January is –15 °F. The average high during July is 57 °F. Temperature extremes can range from –54 °F to 85 °F. Snowfall averages 57 inches with 8.6 inches of rain per year. Table 5 provides temperature, rain, and snowfall data by month for the Kotzebue station (47-year period of record), located about 60 miles southeast of Portsite. Summer fog often impacts air access to Red Dog Mine airstrip and can affect shipping operations. According to a pilot, fog is most frequent during the months of May (10 days), June (11 days), July (9 days), August (9 days), September (6 days), and October (6 days). A pilot working at DMT notes: "It is heaviest in May and June. Fog is most dense in the morning hours but can last all day. It has occasionally lasted for several days. In July and August in the Bering Strait and Chukchi Sea, visibilities drop below 2 miles 10 to 25 percent of the time."

Table 5. Climatological Data for Kotzebue, Alaska

	Temperature (F°)			Rain (in.)			Snowfall (in.)		
Month	Mean	Highest	Lowest	Mean	Greatest	Least	Mean	Greatest	Least
January	-1.3	39	-49	0.41	1.77	T	6.3	23.9	T
February	-4.0	40	-52	0.34	1.23	0.00	5.1	14.0	0.0
March	0.8	39	-48	0.38	1.23	T	6.1	21.9	T
April	12.4	48	-31	0.35	1.41	0.05	4.8	18.1	0.3
May	31.7	70	-12	0.35	1.05	T	1.6	12.0	0.0
June	44.2	85	24	0.54	1.43	0.01	0.1	2.4	0.0
July	54.0	85	30	1.44	3.51	0.01	0.0	0.1	0.0
August	52.0	80	29	2.08	5.18	0.08	0.0	0.3	0.0
September	41.8	69	13	1.52	4.31	0.03	1.2	7.4	0.0
October	23.5	51	-19	0.78	3.20	0.04	6.8	18.0	0.5
November	8.5	38	-36	0.58	2.22	0.09	8.8	24.3	1.1
December	-1.2	37	-47	0.48	1.40	T	8.1	23.6	1.2
Annual	22.0	85	-52	9.27	14.76	5.07	49.0	88.0	21.1

Source: National Climate Data Center, NOAA

2.6. Winds

Metrological data including wind speed and direction are collected at DMT by TCAK. During the winter and spring months of 2000, winds at Portsite generally blew the strongest and most often from easterly directions. In June, with open water prevailing, the winds shifted and generally blew from southerly directions. These southerly wind patterns, with occasional westerly blows, prevailed through September, when the general wind pattern once again shifted to easterly directions. A wind hindcast was performed for the years 1985 to1999 by Oceanweather Inc. (under contract to the Coastal Hydraulics Laboratory) to accurately reflect the forcing mechanism for the wave and current modeling, which in turn provided input to the sediment study and the ship simulation study. The hindcast was later extended to 2000 and checked against recorded wind at the National Data Buoy Center (NDBC) buoy 46035 in the Bering Sea (figure 14) and NDBC buoy 48011 at Portsite. Wind data generated from the hindcast are shown in Appendix A.

2.7. Tides

The Portsite is in an area of semi-diurnal tides with two high waters and two low waters each lunar day. Tidal parameters at the DeLong Mountain Terminal are similar to those determined by NOAA for Station 949-1253 - Kivalina, Corwin Lagoon Entrance (67º43.6'N, 164º35.5'). The tidal parameters in table 6 were determined by NOAA using data from the period October 1, 1985 to September 30, 1986.

Table 6. Tidal Parameters - Kivalina, Corwin Lagoon Entrance

Parameter	Elevation (ft MLLW)
Highest Observed Water Level (11/10/1985)	4.16
Mean Higher High Water (MHHW)	0.90
Mean High Water (MHW)	0.77
Mean Sea Level (MSL)	0.43
Mean Low Water (MLW)	0.10
Mean Lower Low Water (MLLW)	0.00
Lowest Observed Water Level (12/19/1985)	-3.12

2.8. Waves

2.8.1. Wave Climate

The Portsite area has an extremely complex wave environment, dominated by local wind-sea conditions. Meteorological conditions in Kotzebue Sound strongly influence Portsite. Wave generation in areas to the north, including the Chukchi Sea and Arctic Ocean, have an impact on extremes at the project site. The Bering Sea and Northern Pacific Ocean are also important, where low frequency energy is radiated from tropical cyclones and large, powerful tropical storms. The Coastal and Hydraulics Laboratory (CHL) of the Engineer Research and Development Center (ERDC) developed a 16-year hindcast of the wave climate at Portsite using wind data generated from the wind hindcast. The wave hindcast was verified using National Data Buoy Center (NDBC) buoy data. NDBC buoy 48011 was deployed just off Portsite for the open water season in 2000 and 2001. The data from this buoy and buoy 46035 in the Bering Sea (figure 14) were used to validate the hindcast results. The potential for low frequency energy that exists at Portsite can be related to northern Pacific decaying typhoons. The data derived from the NDBC buoy 48011 suggest an approximate maximum swell height of 0.66 feet. Examination of the hindcast (1985-2000) indicates that the month of October has the highest propensity for long-period waves. Fast-moving systems imply a rapidly changing, highly unsteady wind field (in terms of both speed and direction), and rapidly changing fetch, all of which strongly influence wave conditions at Portsite. The wave climate at the DMT is characterized by a predominance of waves under 3.3 feet. When higher waves greater than 6.6 feet do occur, it is usually for a short duration of 24 to 48 hours. Details on the development of the wave analysis can be found in Appendix A.

2.8.2. Determination of Weather Days During Shipping Season

The termination of loading activities at DMT is based on subjective sea and weather observations. If seas appear to be building or weather worsening, loading may cease to wait out the conditions and see if they worsen. Weather systems move rapidly through the area, with seas quickly building and subsiding. Horizontal velocities and vertical motions can become quite pronounced with very moderate approach wave heights and periods. Current shipping operations at the barge loader are related to the occurrence of 3.3-foot (1 meter) waves at DMT. Waves greater than 3.3 feet (1 meter) are reported to cause too much motion for the barge loading operation. Once the barges are loaded and underway to the bulk container ships, waves up to 6.6 feet can be tolerated. This is due to the barges being able to conduct their ship loading operations in the lee of the ship, which acts as a floating breakwater. All loading shuts down in waves greater than 6.6 feet. On that rare occasion, loaded barges go to one of the buoys to wait out the storm.

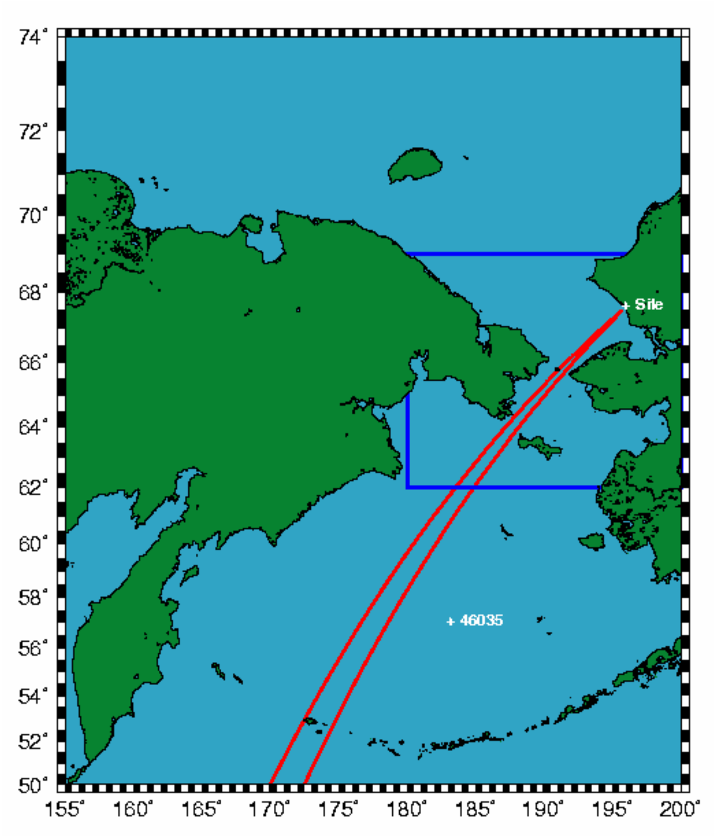

Figure 14. Location of NDBC Buoy 46035

The relationship between the percent occurrence of 3.3-foot (1 meter) and 1.6-foot (0.5 meter) waves in the hindcast provides a basis for determining loading shut down by Foss Maritime, the company operating the tugs and barges. Table 7 lists the actual usable shipping days (weather days subtracted) as reported by Foss Maritime and the usable days based on the hindcast weather days, defined as the percent occurrence of waves >3.3 feet (1 meter) at the –62 foot (-19 meters) and the percent occurrence of waves >1.6 feet (0.5 meter) at the –20 foot (6.1 meter) contour. An analysis of the impact of the loading delays on queuing was performed for the economic analysis and is contained in Appendix E.

2.9. Open Water Shipping Season

Weekly historical ice conditions at the Portsite were extracted from the United States Ice Center's Sea Ice Grid (SIGRID) database from 1972 to 2001. Table 8 shows the earliest and latest open water season dates based on ice cover data. Table 9 lists the minimum, mean, and maximum seasons based on the ice data. However, the start of the shipping season is based on the presence of ice in the area and the completion of the subsistence hunting season by the Natives. The shipping season typically begins in early July. Equipment needs to be demobilized from the site before the Bering Straits ices over and prevents travel to or from the site. The actual start and finish shipping days for Foss Maritime from 1990 to 2000 are presented in table 10.

Table 7. Comparison of Weather Days

Year	Usable Days Based on Foss Report	Usable Days Based on Hmo>3.3 ft (1 m.) at the –62 ft (-19m) contour	Usable Days Based on Hmo>1.6 ft (0.5 m) at –20 ft (-6.1 m) contour
2000	67	64	55
1999	106	107	101
1998	75	80	79
1997	77	88	85
1996	62	63	55
1995	78	78	69
1994	70	66	59
1993	68	68	59
1992	66	73	64
1991	91	84	78
Total	760	751	704

Table 8. Open Water Season Dates 1972 to 2001

	0 Tenths Ice Cover		5 Tenths Ice Cover	
	Ice Out	Ice In	Ice Out	Ice In
Earliest Date	9 June	4 October	7 June	9 October
Mean Date	6 July	29 October	27 June	4 November
Latest Date	28 July	19 November	18 July	23 November

Table 9. Open Water Season Length [days] 1972 to 2001

	Ice Cover	
	0 Tenths Ice Cover	5 Tenths Ice Cover
Minimum Season	78	108
Mean Season	115	131
Maximum Season	148	160

Table 10. Historical Shipping Start and Finish Dates

Year	Start Date	Finish Date	Total Days
1990	18 July	3 October	77
1991	4 July	8 October	96
1992	11 July	30 September	81
1993	7 July	6 October	91
1994	15 July	13 October	90
1995	7 July	30 September	85
1996	7 July	28 September	83
1997	4 July	11 October	99
1998	8 July	18 October	102
1999	14 July	1 November	110
2000	12 July	16 October	96
2001	6 July	14 October	100
2002	5 July	24 October	111
2003	5 July	16 October	104
2004	2 July	12 October	102

2.10. Currents

Investigation of currents consisted of a literature search for information in the area, deployment of instrumentation, and modeling to characterize the site. The Climactic Atlas of the Outer Continental Shelf Waters and Coastal Regions of Alaska Volume III indicates that a warm current enters the Chukchi Sea via the Bering Strait. The current concentrates near the surface and overlies dense, relic bottom water. It has a uniform velocity of 0.87 knots in the summer and 0.20 knots in the winter. Near-shore current patterns and velocities are complicated and variable because of coastal configuration, bathymetry, and winds. The currents do primarily appear to be wind generated. During 1998 to 2000, current data was obtained by PN&D at Portsite. Instruments were deployed in shallower water during the open water season and moved to deeper water before ice-cover moved in. During the open water season, currents seem to flow along the coast, both northward and southward. Northward-flowing currents occurred approximately 70 to 75 percent of the time, with southward currents happening the remaining 25 to 30 percent of the time. The highest recorded northbound current in the upper portion of the water column, where velocities tended to be greatest, was 2.3 knots. The largest current flowing to the south, also measured in the upper part of the water column, was approximately 0.9 knots. Current data was also collected in the middle of winter under ice cover. Occasionally, high currents were measured when ice cover and low velocities were expected. This condition was possibly due to ice-related phenomena, like the formation of a lead in the ice, which forces water to flow to an open area. During a number of winter months, currents were small, less than 0.2 knots, for 90 to 100 percent of the month. Additional information on currents can be found in Appendix A.

2.11. Contaminants in Arctic Marine Waters

Much of the arctic environment is receiving pollutants, including heavy metals such as cadmium and mercury, and persistent organic pollutants (POP) such as polychlorinated biphenyls (PCB) and pesticides from areas outside the arctic. A significant method of transport to the arctic ecosystem is upper-atmosphere winds originating in the industrial areas of Asia and Europe. The Brooks Range in Alaska has huge naturally mineralized areas that for eons have been contributing (heavy metals including lead, zinc, and cadmium) to sediments in the Chukchi Sea and Arctic Ocean through the natural process of erosion by wind, water, and ice. However, most local contaminants introduced to Alaskan arctic waters are quickly dispersed and diluted to below threshold levels, assimilated by living organisms, or chelated (bonded with other elements or compounds) into inert forms where they eventually end up in the sediments on the seafloor. Additional information on components of the bottom sediments or the water column can be found in the EIS.

2.12. Geotechnical Conditions

Geotechnical investigations were conducted by PN&D in 1998 at Portsite. These included 31 offshore boreholes (22 in the dredging corridor), 13 onshore boreholes, 5 boreholes in the Portsite Lagoon, 120 in-place penetration tests, 37 locations for marine sediment sampling, a sub-bottom profiling and sidescan sonar survey covering a strip along the dredging corridor 4 miles wide out to the -70-foot MLLW bottom contour, and standard laboratory testing for grain size, specific gravity, moisture content, triaxial strength, rock unconfined compressive strength, liquid limit, plastic limit, plasticity index, and chemical analyses. The offshore geotechnical subsurface profile is shown on plate 11. The boring logs are shown in Appendix B. The sea bottom at the site is gently sloping with large areas of sand/silt interspersed with sand areas and sand/gravel areas. The coarser gravel areas are concentrated in the near-shore area in water depths less than 45 feet. The upper soil layer generally consists of fine-grained soils that vary from firm to very hard in consistency and sandy soils that are typically medium dense. Occasionally, organic soil layers and lenses of peat are encountered. Subbottom profiling and boreholes indicated that the subsurface materials are composed of a layer of sand/silt/gravel/clay materials (from 10 to 25 feet thick) overlying a denser layer of sand/gravel (from 10 to 100 feet or more thick) and a basement material of sandstone bedrock. The deeper sand/gravel materials protruded near the surface in sporadic locations in the survey area. Geological evidence indicates that the sand/gravel materials may be alluvial deposits. The submerged gravel and coarse sands may be remnant gravel beaches. The bedrock surface in the project area varies from north to south and east to west. Bedrock is 39 feet below the seabed at the shore end of the project and 90 feet below the seabed at the 40 to 45-foot depth contour. Beyond this water depth, rock was not detected with the equipment used. Bedrock coring indicates that the upper several feet of bedrock is weathered, the material is homogenous, becoming more competent with depth, and described as either lavender or gray sandstone.

2.12.1. Seismic Conditions

Structures at Portsite will be periodically exposed to the effects of ground shaking from earthquakes. Operating level earthquake motions should be resisted with only minor non-structural damage. Larger earthquake motions, designated contingency level, should be resisted by structures to continue their functions while preventing their collapse during plastic deformation. The respective return intervals for operating and contingency earthquakes used in this study were 72 years and 475 years (equating to a 10 percent chance of occurrence in a 50-year period). The most recent seismic hazard maps for Alaska indicate peak horizontal rock accelerations of 0.08g and 0.20g, respectively, for the 475-year and the

2,475-year (maximum credible earthquake) events. The peak horizontal rock acceleration during the 72-year event is about half the 475-year event, or about 0.04g. Loss of soil strength due to ground shaking is not an important consideration for Portsite because the marine foundations will be based on bedrock, and because the over-consolidated soils, high in silt content (10 to 30 percent) present at the site, are unlikely to liquefy in the moderate seismic design conditions for Portsite. However, underwater slopes along the dredged channel would be susceptible to liquefaction failure during ground shaking, causing localized slumping or slope failure, which would need to be considered in determining dredging maintenance volumes.

2.12.2. Permafrost

Northwest Alaska is within the continuous permafrost zone and almost all areas of the terrestrial Portsite area are underlain with permafrost to within a few feet of the surface. The depth of permafrost on land can vary up to hundreds of feet but is apparently thin or absent under most of the Chukchi Sea except for a narrow band along the shore and under the northernmost portion. Holes bored to bedrock on the beach and seaward did not, however, indicate a presence of permafrost at Portsite seaward of the beach or under the beach lagoons. Sandstone bedrock was encountered at -50 feet at the beach and bedrock surfaces near the quarry approximately 1 mile inland. The depth of permafrost between the beach and the surfacing bedrock is undefined, but it is assumed to extend from near the surface to bedrock in the terrestrial area. Patterned ground and tussock vegetation indicative of near-surface permafrost exists in the Portsite area.

2.12.2.1. Sediment Movement

The predictions of sediment transport rely heavily on the estimated environmental conditions at the site, specifically the wave hindcasting work and the simulations of circulation in the Chukchi Sea. The sediment properties along the length of the channel were determined from shallow core sampling and onsite erosion rate experiments. The combined environmental conditions and sediment property information were then used in a sediment transport model. Model-estimated channel infilling volumes were analyzed to determine the along-channel distribution of sediment infilling and the return intervals for infilling volumes. In addition to the channel infilling rates, longshore sediment transport was estimated from the 16-year wave hindcast. A detailed description of sediment movements throughout the Portsite area is given in Appendix A, Hydraulic Design.

2.12.2.2. Near-shore Sediment, Grain Size, and Distribution

The near-shore sediment classes at Portsite range from fine gravel to silt. In 1998, PN&D sampled surface sediments at 24 locations along a cross-shore profile inline with a proposed channel location and at three locations approximately 17,060 feet south of the proposed channel location. In July/August 2000, six shallow core samples were collected at four locations along the proposed navigation channel. The bulk of the coarse-grained material is found from the shore face to the –39-foot contour. Six shallow core samples, approximately one foot in length, were collected along the length of proposed channel and tested using SEDFLUME, a false-bottom flume that allows the determination of shear-stress/erosion relationships of minimally disturbed sediment samples. Shear stress/erosion relationships were determined for each of the six core samples collected.

2.12.3. Longshore Transport

The beach sediments were observed to be variable along the shore with regions of shoreline composed of gravel and other regions composed primarily of coarse sand. Longshore transport was estimated by applying the 16-year offshore wave climate from the wave hindcasting study. The waves were transformed, and breaking wave conditions were supplied to the longshore transport model. The average annual net transport rates are approximately 11 to 18 percent of the gross transport rate, indicating a weak overall directional bias in transport to the south. On an annual basis, however, the net transport can be as large as 70 percent of the gross transport. The annual net transport estimates suggest that approximately half the years simulated have net transport to the north and half have net transport to the south, but the overall net transport averages approximately 3,008 to 5,493 yd^3 to the south. The maximum net transport was estimated at 26,159 yd^3 to the south, and the maximum net transport to the north was estimated to be much smaller at 6,147 yd^3. Longshore transport is weakest during the months of June, July, and August when wave energy is the lowest, while the months of September, October, and November have higher wave energy and consequently more longshore transport.

2.12.3.1.Littoral Drift Build up at Shallow-Water Dock

Since construction of the shallow-water dock in 1986, sediment has impounded on the north side of the dock, requiring mechanical bypassing of material to the south. This suggests that the net longshore transport at Portsite is to the south, which agrees with CHL model predictions. Contrary to the net sediment transport, the general trend of the currents at the site is from south to north. The majority of sediment movement appears to occur during large storm events. The material impoundment at the dock is not a yearly maintenance activity, with maintenance bypassing only performed on an as-needed basis, most recently in October 2002. The previous bypassing activity took place in 1997. The long-term consequences of having a hardened structure along the beach are evident in aerial photographs (figures 5 and 7). The once linear beach now has a discontinuity, with the beach south of the dock appearing to recede, while the beach to the north appearing to grow. Any navigation improvement plan for DMT must consider sediment bypassing at the shallow water dock in any maintenance plans.

2.12.3.2. Sediment Movement Under Ice Cover

The near-shore current measurements suggest that the currents under ice cover are typically much less than the critical velocities to produce sediment transport. However, measurements indicate that near-bottom, under-ice currents may reach velocities in excess of 1.9 knots for up to a day in duration. These large, observed currents were directed offshore and are suspected to be associated with breaks, or leads, in the ice cover. Sediment transported by these events is not expected to produce significant infilling of the channel.

2.13. DMT Sounds

One of the critical factors identified by the resident Natives in the area during the scoping process for consideration in the IFS was the effect that noise generated by navigation improvements, both during initial construction and project operation, might have on those marine mammals that transit the Chukchi Sea and form the core of traditional subsistence activities. Consequently, in 2000 the Corps conducted sound surveys in the area surrounding

Portsite. Recordings were made at three times of the year: when ice was present in May, during breakup in June, and during the open water period in August. A detailed discussion regarding the sounds recorded in proximity to Portsite can be found in the EIS.

Noise, likely created by onshore generator operation at DMT, was measured 1,300 feet directly offshore by sensitive equipment on a calm day in late winter. Other onshore noises, such as truck movement, people talking, and other daily activities could not be specifically singled out from the generator noise. Not much sound from operations goes into the waters of the Chukchi Sea before the ice goes out. There generally is no activity in the water or on the ice related to DMT.

Maintenance, barge loading and unloading activities, tugs, and ships all contribute to noise heard through the atmosphere during the July-October shipping season. The sounds heard the greatest distance seaward from Portsite are noise produced by ships and tugs associated with loading ore concentrate onto the bulk freighters. Tug sounds are almost continuous, at varying intensity, during good weather and sea conditions throughout the shipping season. Peak noise generated by tugs at Portsite, measured at 133dB very close to the source, might be detectable up to about 6.5 miles directly seaward from the source, and a much shorter distance to the north and south. Thus, tugs involved in assisting the lightering barge at the freighter, about 3 miles offshore, could likely be heard approximately 9.5 miles offshore, before the sound attenuates to background levels (figure 15). Other sounds generated at DMT were much less powerful than tug noises and would not appreciably affect how far seaward the DMT operations might be heard. Ship departure is the loudest regularly occurring underwater sound event. A bulk carrier was measured producing about148 dB at 100 meters and would have been detectable to sensitive instruments up to 16.5 miles seaward, or about 20 miles offshore from Portsite. Ships produce less prop cavitation after they reach standard speed and thus less sound. The level of sound from a ship traveling at cruising speed through the open, Chukchi Sea would likely approach background levels at a distance less than 16.5 miles.

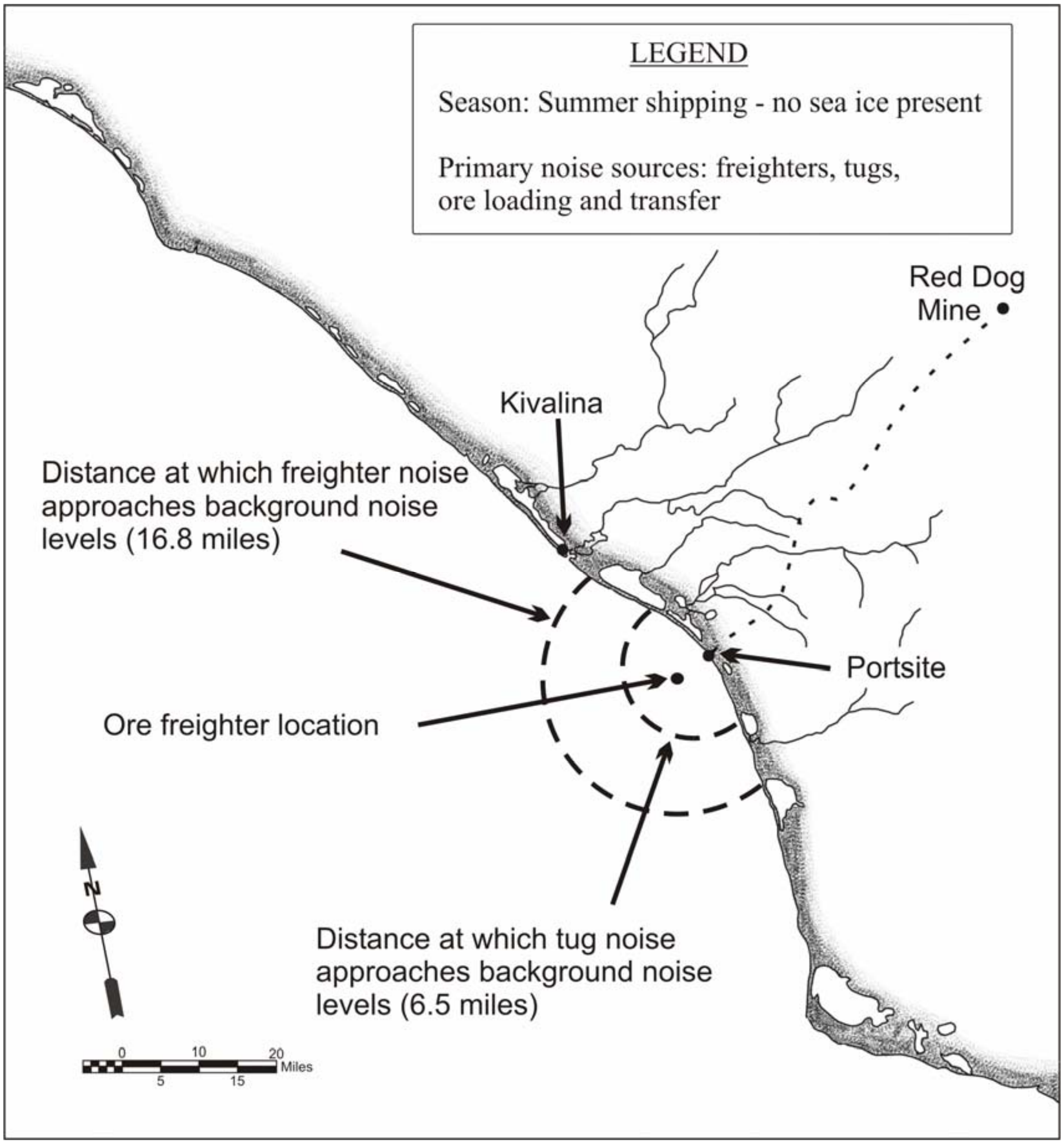

Figure 15. Typical distances ore loading operation noises travel before decreasing to ambient levels

2.14. Introduction to Economic and Environmental Study Areas

The following paragraphs provide a description of the general legal organization of the state of Alaska, define those areas in which economic and environmental studies were conducted, and summarize the social, economic, and environmental conditions in the area. The economic and environmental study areas differ from the study area previously described for consideration of DMT navigation improvements. The plan formulation study area has a narrow focus intended for identifying, evaluating, and comparing the various alternatives designed to address the problems and needs of DMT. The economic study area provides a broader perspective of the area potentially affected economically by DMT navigation improvements. The environmental study area is also broader than the plan formulation study area, covering that area in which significant environmental impacts might occur. Both narrow and broad perspectives are useful in understanding the complex and intertwined issues that may arise as a result of future DMT navigation improvements.

2.15. Civil and Native Governmental Organizations

The relationship between civil governmental organization and Native organizations in Alaska are summarized in table 11. Because of unique circumstances involved in the development of Alaska during the last century, the relationship between the civil government and Native organizations, with one exception, is different than in the other 49 states. Civil government in Alaska, established in the Alaska State Constitution, which became effective upon statehood on January 3, 1959, provided for two levels of government under the state: boroughs (similar to counties) and cities of various classes. Boroughs have been established covering less than half the area of the state with the remainder being unorganized (unboroughed) at the regional level. Tribes are defined as those Native entities within Alaska recognized and eligible to receive services from the Department of Interior, Bureau of Indian Affairs (BIA). The BIA has recognized 229 such entities in Alaska, most of which are relatively small communities. Of these, there is only one “traditional” Indian Reservation in Alaska in which the tribal organization has control of the land, the Metlakatla Indian Community, on Annette Island south of Ketchikan at the southern end of the Alaska panhandle. All other Native communities come under provisions of the 1971 Alaska Native Claims Settlement Act (ANCSA) that extinguished aboriginal native land claims in Alaska and vested the land rights for 44 million acres in Regional (subsurface rights) or Village (surface rights) For-Profit Corporations. Both the Regional and Village Corporations are legal entities separate from the BIA recognized Tribe. Subsequently, in 1980 the Alaska National Interest Lands Conservation Act (ANILCA) granted a subsistence preference for individual Alaska Natives on Native controlled land and for both Native and non-Native rural residents on public land.

Table 11. Native and Civil Governments and Organizations

State	Tribal	Alaska Native Claims Settlement Act	Level
State of Alaska	Alaska Inter-Tribal Council: Statewide Tribal Organization (177 tribes); advocacy for tribes.	Alaska Federation of Natives (AFN): Statewide Native Organization (non-tribal).	Statewide
Borough Assembly: State chartered regional municipal government.	Regional Tribal Consortium/Non-Profit: Service delivery to tribal members/tribal advocacy.	ANCSA Regional Corporation: State chartered regional for profit; owns subsurface rights.	Regional
City Council: State chartered municipal government.	Tribal Council: Federally recognized tribal government by Bureau of Indian Affairs.	ANCSA Village Corporation: For profit village corporation; owns surface rights.	Local

Portsite and the Red Dog Mine are in the Northwest Arctic Borough (NWAB). Organized boroughs in Alaska are in some ways like counties in much of the rest of the United States, but with political structure and powers that may be substantially broader. The NWAB is the second largest borough in Alaska and encompasses almost 36,000 square-miles of land, making it about the size of the state of Indiana. The NWAB has a total population of about 9,000 people, or about 1 person for every 4 square miles. By comparison, Wyoming, the least populated of the 50 states has about 5 people per 1 square mile (about 20 times the population density of the NWAB). Native Americans make up about 87 percent of the population of the NWAB and only about 0.1 percent in Indiana. However, since there are so many more people in Indiana, there are about three times as many Native Americans per square-mile in Indiana as there are in the NWAB. The regional Native corporation for this area, the Northwest Arctic Native Association (NANA), has the same geographic boundary as that of the NWAB. NANA controls 2,300,000 acres of land, having consolidated the Village Corporations into NANA, the Regional Corporation. NANA controls both the surface and sub-surface rights for the bulk of the land containing the Red Dog Mine zinc deposit.

2.16. Economic Study Area

The economic study area, shown on figure 16, is defined as the largest potential area that might benefit from lower fuel costs due to navigation improvements at Portsite. It encompasses the NWAB, the western half of the North Slope Borough (NSB) and a large unboroughed area in west central Alaska, which includes all of the Nome and Wade Hampton census areas and the western part of the Yukon-Koyukuk census area. This area is about a quarter of a million square miles, being approximately 1-1/2 times the size of California. It generally includes the western coast of Alaska and inland areas from Barrow on the Arctic Ocean at the meeting of the Chukchi and Beaufort Seas, south to the Yukon delta, and then eastward to the 156th Meridian. Information on area and population of the five borough/census areas and the local communities therein that could be potentially affected by the proposed project are shown in the following two tables. Table 12 compares the regional areas with “outside” states. Table 13 provides a listing of the villages within each of the areas that are also considered part of the economic study area (villages outside the economic area are not listed). Each regional area generally has at least one city that serves as a transfer point, a hub for people and materials coming from or going to the smaller villages nearby (Barrow, Kotzebue and Nome). Greater detail is contained in the Economic Appendix.

Table 12. General Information about Census Areas

Census Areas	Population	Area (mi^2)	State Equivalent	Density (person/mi^2)
Northwest Arctic Borough	8,898	36,000	Indiana	0.25
North Slope Borough	9,368	90,000	Oregon	0.10
Nome Census Area	9,200	23,000	New Hampshire, Vermont, and Massachusetts	0.40
Wade Hampton Census Area	7,000	17,000	New Hampshire and Vermont	0.41
Yukon Koyukuk Census Area	6,500	157,000	California	0.04
Total	**34,949**	**226,500**		**0.15**

Table 13. Communities Potentially Benefited Economically By Project

Northwest Arctic Borough		North Slope Borough		Nome Census Area		Wade Hampton Census Area		Yukon Koyukuk Census Area	
Community	Pop.	Community	Pop.	Community	Pop.	Community	Pop.	Community	Pop.
Ambler	309	Point Hope	757	Nome (EH)	3,505	Alakanuk	652	Anvik	104
Buckland	406	Point Lay	247	Brevig Mission	261	Emmonak	767	Shageluk	129
Deering	136	Wainwright	546	Diomede	172	Kotlik	591	Grayling	194
Kiana	388	Barrow (EH)	4,581	Elim	284	Marshall	349	Kaltag	254
Kivalina	377	Kaktovik	293	Gambell	636	Mountain Village	755	Nulato	336
Kobuk	109			Savoonga	615	Pilot Station	550	Koyukuk	101
Kotzebue (EH)	3,082			Golovin	163	Pitka's Point	125	Galena	675
Noatak	428			Koyuk	280	Russian Mission	296		
Noorvik	634			St Michael	351	St Mary's	500		
Selawik	772			Shaktoolik	231				
Shungnak	256			Shishmaref	537				
				Stebbins	507				
				Teller	278				
		1/		Unalakleet	798	2/			
				Wales	152				
Total (87% NA)	**6897**	**(70% NA)**	**7367**	**(81% NA)**	**8770**	**(95% NA)**	**4585**	**(63% NA)**	**1793**

EH = economic hub, NA = Native American, Population data for year 2000

1/ 289 in 3 villages not in study area 2/ 2,445 in 4 villages not in study area

Figure 16. Economic study area and communities potentially affected by proposed project.

2.17. Social and Economic Conditions of Northwest Alaska

Northwest Alaska has no major highway system as compared with the highway systems found in the lower 48, contiguous states. In fact, it has very few total miles of road considering its extremely large area. The only roads in northwestern arctic Alaska are the 52-mile-long Red Dog Mine gravel road, the 26 miles of gravel roads around Kotzebue, about 20 miles of gravel road near Barrow, and several hundred miles of gravel road linking Nome with Teller, Council, and the Kougarok River. Almost all the communities have no improved roads within themselves or connecting with the other rural communities. Northwest Alaska has no highway connection to the rest of the State and no railroad system.

Besides the three economic hubs of Kotzebue, Nome, and Barrow that have daily jet service from Anchorage and/or Fairbanks and the gravel airstrip at the Red Dog Mine, all the other communities rely on shorter, gravel airstrips designed for small aircraft, with a few able to handle DC-6s. Transportation between the communities is almost entirely by aircraft and boat during the open water season, and by small aircraft and snow machine when waters are frozen. Red Dog Mine does have an airstrip that is capable of landing heavy commercial aircraft.

Northwest Alaska has no deepwater ports or fully developed harbors. There are shallow-draft harbors at Portsite and Nome. Essentially, all goods are transported by sea or air. Since most of the rural communities are near water, both marine and riverine communities receive most of their goods by beaching shallow-draft barges near the community. Ice limits marine commerce to about four to six months of the year. The ice goes out on most rivers and lakes in May or June and on the Chukchi Sea in June or July. Rivers and lakes begin freezing in late September, and waterborne transportation ends in both freshwater areas and the Chukchi Sea by about the end of October. Norton Sound ices up in early November. There is no regional electrical grid or electrical interconnection between communities. Diesel generators produce electricity for each community’s electrical system. Near Kotzebue and a few other communities, wind power generators provide a portion of the community’s power needs.

Though small amounts of locally grown produce may be exchanged in Northwest Alaska, there is no export agriculture, no commercial timber harvest, and no manufacturing other than Portsite support facilities. The residents produce handicrafts, art, and engage in light fabrication for local use. A few boats fish commercially for local sale to small processors.

There is an operating mine at Candle on the northern side of the Seward Peninsula. Except for a few small placer mines that operate seasonally and the Red Dog Mine operations, there is no other mineral or commodity resource extraction, including oil, gas, and coal production, in northwestern arctic Alaska. Red Dog Mine represents almost the entire industrial base for the NWAB, and the main source of tax and royalty income for both the NWAB and NANA. The NWAB has no income tax, no sales tax, and no real estate tax. Other than revenue generated by Red Dog Mine, most of the financial base for the Borough and its residents comes from the state and federal governments, and from service jobs supporting people and activities in the borough. The sparse economic base, high unemployment, and lack of agriculture are partially offset by harvest of wildlife, fish, and plant material. This harvest is collectively called “subsistence.” It is the primary source of food for many people and is a significant food source for almost everyone in the borough. Subsistence also is at the center of tradition and culture for many of the people of the borough.

The strongest employment sectors within the study area are typically government and education, and both survive only with the help of transfer payments from the federal and state governments. Transfer payments tend to make up an inordinately large share of personal income including fund transfers to non-profit agencies, retirement, public assistance and other payments from government to individuals such as the State Permanent Fund earnings, grants, retirement, disability benefits, etc. Typically, significant shares of the transfers are related to payments for health care (the Alaska Native population receives free health care by federal mandate). Many employees in the mining, petroleum, or fishing industries are either seasonally supplied and their primary residence is outside the area, or are rotated between job sites and place of residence (usually out of the region) as frequently as every 2 weeks. Thus, employee wages are also typically spent outside the study area. There is little basic employment in the traditional sense of exporting manufactured goods, and most of the support goods and services needed by the basic industries are shipped in as needed.

2.18. Northwest Alaska Transportation Plan

The State of Alaska Department of Transportation and Public Facilities is currently developing a statewide transportation plan. Because of the wide diversity present in Alaska between regions, the statewide plan has been divided into segments by region, one of which is the Northwest Alaska Transportation Plan (NWATP). This plan encompasses the entire NSB west of the Dalton Highway (road between Fairbanks and Prudhoe Bay), the Seward Peninsula, the western coastline as far south as Saint Michael and Stebbins on Norton Sound, Saint Lawrence Island, and Little Diomede Island. This area covers approximately 217,865 square miles, about halfway between California and Texas in size, but has a population of only about 26,000 persons. The purpose of the plan is to prepare a strategy to guide transportation infrastructure development in Northwest Alaska. The plan is divided into two major elements: The Community Transportation Analysis (CTA) and the Resource Transportation Analysis (RTA), with separate reports for each.

2.18.1. Community Transportation Analysis

The CTA Report, published in February 2004, identified a number of local transportation needs that will be pursued by Alaska in the next decade. These include (1) marking village-to-village winter trails with GPS-mapped, 8-foot-tall tripods; (2) improving village airports by lengthening runways and aprons and adding GPS landing systems and lights; (3) constructing village barge landings; (4) improving mainline barge fuel operations; (5) constructing local development roads to materials sources, boat and barge landings, and emergency evacuation; and (6) studying a plan for a Yukon River Highway from Fairbanks, possibly to Nome and Unalakleet.

2.18.2. Resource Transportation Analysis

The RTA considered world market trends and transport economics for minerals, coal, oil, and gas, as well as traditional transportation routes to northern Alaska mineral and energy resources. It identified potential transportation projects that could possibly come into existence over the next 20 to 40 years. The western arctic coalfields, owned by the Arctic Slope Regional Corporation, could be developed over the next 40 years in two stages. The first stage (possibly 10 to 25 years in the future) might involve a mine-mouth power generating plant, producing electricity and a 90-mile-long transmission line to Red Dog

Mine. A second stage (possibly 20 to 40 years in the future) could involve a road or railroad from the ASRC coalmine to Red Dog Mine, enabling the land transport of coal to Portsite for export. DMT navigation improvements will be included conditionally in the RTA Plan, dependent upon a favorable recommendation by the Corps and AIDEA. In addition, the state will evaluate a mainline fuel barge and freight port on the middle Yukon River (near Holy Cross or Ruby) with local roads to area mines and villages and a new road from the Dalton Highway (Deadhorse) to the village of Nuiqsut, which would provide road access for fuel and freight and facilitate the development of oil and gas production in the National Petroleum Reserve Alaska. The state is currently preparing the final RTA report.

2.19. Biological Resources

The following paragraphs summarize existing biological resources in the vicinity of the Portsite. For greater detail regarding all biological resources in the vicinity of Portsite, please see the draft Environmental Impact Statement.

2.19.1. Wetlands

Wetlands of the United States are identified and classified using Corps of Engineers and U.S. Fish and Wildlife Service definitions and guidelines based on vegetation, soils, and hydrology data. These guidelines are somewhat more complex in arctic environments with the inclusion of permafrost. Except for the beaches, berms, and the alpine highlands in the Portsite area that are well drained, the tundra areas surrounding the Portsite are considered wetlands. These areas are characterized by poor drainage, areas of standing water, and saturated soils that support a variety of water plants. The wetland areas in the Portsite area are shown in figure 17.

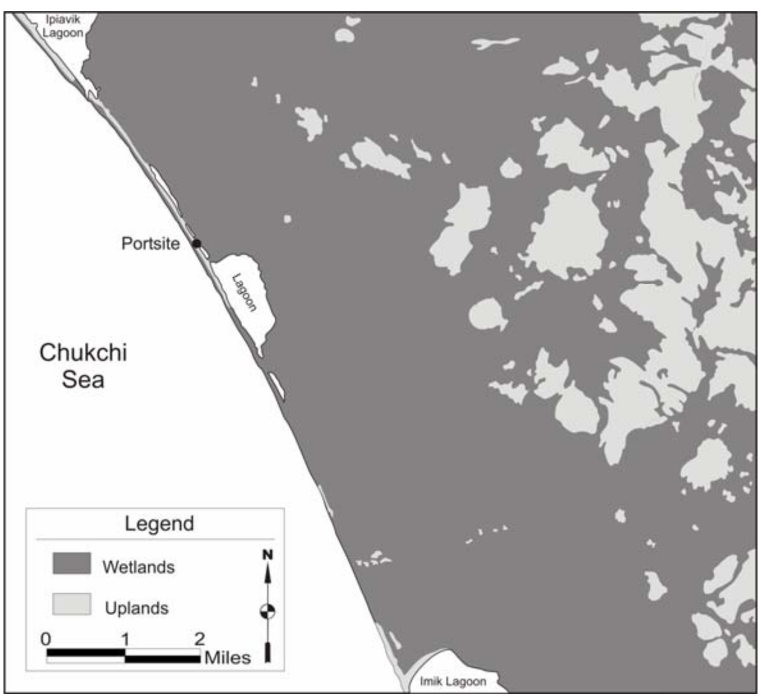

Figure 17. Wetland and upland areas surrounding Portsite.

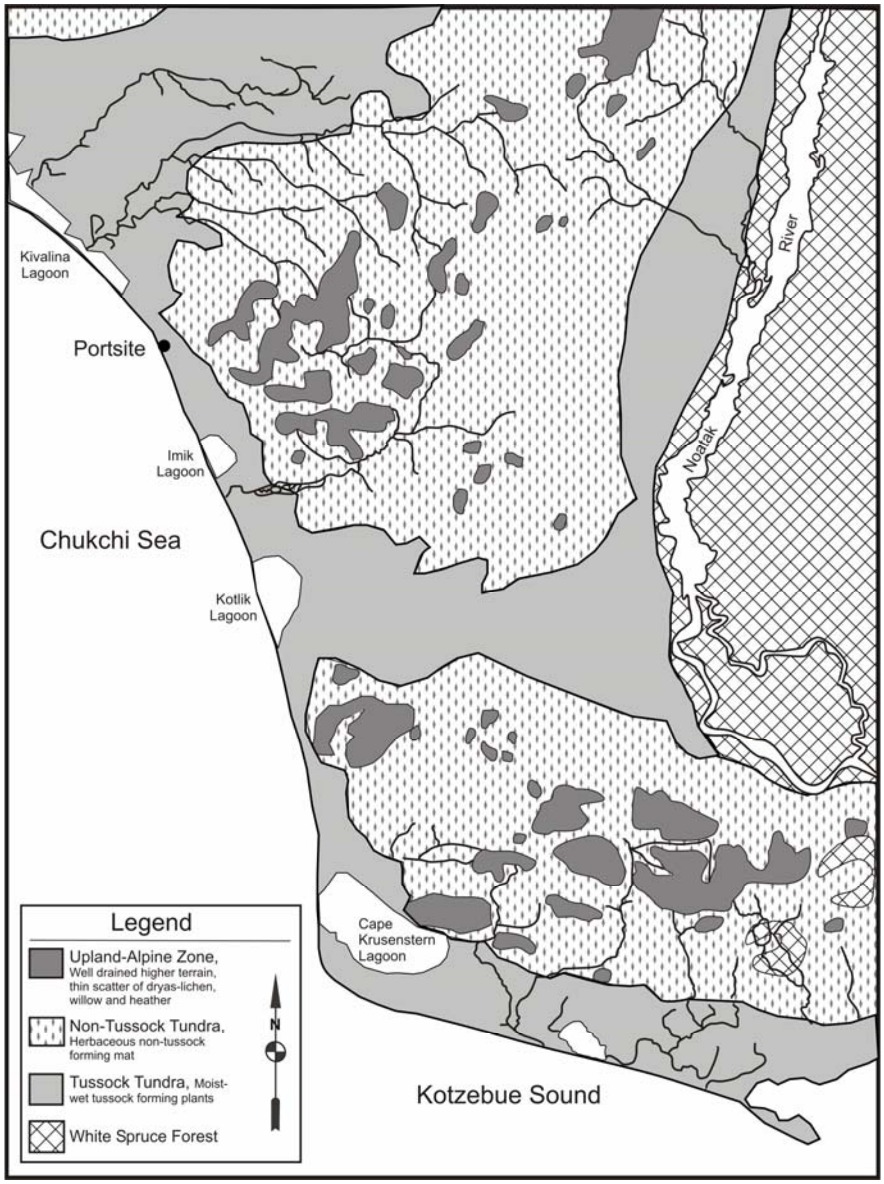

Figure 18. Zones of vegetation near Portsite and in Cape Krusenstern National Monument

2.19.2. Vegetation

Land vegetation communities in the Portsite area include tall-grass herbaceous growth on beach berms, transitioning inland to a mosaic of low shrub tussock tundra, sedge-grass tundra, wet meadow, marsh, and wetland herbaceous zones. As land elevations increase inland, mat and cushion alpine tundra communities are predominant, culminating with sparse or vegetation free zones at the highest elevated inland areas. Elymus grasses dominate vegetation on the beach berm, and sedge grasses dominate inland tundra. Areas of low and tall shrub also exist in riparian and upland areas. Higher elevations are dominated by dwarf shrub, mat, and cushion tundra where vegetation is present. Figure 18 presents these general vegetation zones in the project area as depicted in a map covering the Cape Krusenstern National Monument.

2.19.3. Marine Mammals

The primary mammals of concern in the northwestern arctic near Portsite are marine mammals, such as bearded seal, ringed seal, Pacific walrus, beluga whale, bowhead whale, and polar bear. The following paragraphs summarize important information on each of these mammals relationship to Portsite.

2.19.3.1. Bearded seal

Bearded seals migrate through the Bering Straits and Chukchi Sea during the spring and fall migrations due to the retreat or advance of ice. Bearded seals are usually found in areas of thin and broken ice along the flaw leads that typically form 3 to 4 miles or more offshore at Portsite.

2.19.3.2.Ringed seal

Ringed seals migrate with the advancing and retreating ice through the Chukchi Sea and Bering Straits. Ringed seals are found closer to shore, usually within ¾ of a mile, but leave the Portsite area shortly after breakup and are not present when the tugs, barges, and ships are loading ore concentrate during the summer.

2.19.3.3. Pacific walrus

Pacific walrus migrate through the Chukchi Sea in June along the receding pack ice. They usually do not come closer to Portsite than 30 to 40 miles or more offshore.

2.19.3.4. Beluga whale

Beluga whales migrate through the Chukchi Sea at different times and routes, depending upon what stock is involved. The two stocks (Beaufort Sea and Chukchi Sea) potentially are impacted. During the northward migration, the Beaufort Sea stock usually migrates in leads that form 3 or more miles offshore at Portsite. The Chukchi Sea stock may migrate close along the beach for at least part of its northward migration. However, the Beaufort Sea stock takes a far westerly route in the Chukchi Sea near Russia during the southward migration. Some of the Chukchi Sea stock returns south down the Alaskan coast, resulting in occasional killing of beluga whales by Kivalina hunters in August or September.

2.19.3.5. Bowhead whale

Bowhead whales migrate through the Chukchi Sea to the Beaufort Sea from March to June, with the heaviest concentrations in April and May. They usually migrate well offshore of Portsite, following leads that are usually 3 or more miles offshore.

2.19.3.6. Polar Bear

Polar bears are found along the coast of the Chukchi Sea during the winter following migrating ringed seals. However, with breakup, ringed seals leave the Portsite area followed by the polar bears. Consequently, polar bears are not found during the shipping season, which starts in July.

2.19.3.7. Marine Invertebrates

The Chukchi Sea floor contains a multitude of marine invertebrates including worms, clams, sea stars, and isopods, other non-mobile or slow-moving species, and species that are more mobile, such as crabs, amphipods, krill, shrimp, and other mobile marine invertebrates. King crabs are found in the Chukchi Sea and are an important subsistence species.

2.19.3.8. Fish

There are three categories of fish found in proximity to Portsite. These are marine, freshwater, and anadromous. Of the 20 marine species found in various samplings (beach seine, ocean seine, fyke net, and trawl), the most abundant species included: starry flounder, Arctic flounder, rainbow smelt, saffron cod, Pacific herring, Atka mackerel, yellowfin sole, and Alaska plaice. Some of these species are important food for the ringed and bearded seals, two of the important subsistence marine mammals. Freshwater species found in the area include: Arctic grayling, whitefish, burbot, northern pike, Alaska blackfish, nine-spine stickleback, and freshwater sculpins. Artic grayling is important as a subsistence fish. Anadromous or semi-anadromous fish found in the area include five species of Pacific salmon, smelts, whitefishes, and ciscoes. Dolly Varden char is the principal fish species in the Wulik River drainage. Whitefish and Dolly Varden char are important to the local subsistence economy.

2.19.3.9. Terrestrial Mammals

Terrestrial mammals found in proximity to Portsite include inland species such as caribou, moose, ptarmigan, Dall sheep, grizzly bear, musk ox, red fox, wolves, and wolverine. Small mammals, such as lemmings, voles, shrews are found in the tundra surrounding Portsite. Caribou and moose are the principal terrestrial mammals hunted in the area, and these two species were identified as resources of special concern during the EIS scoping meetings.

2.19.3.10. Birds

Birds found in the Portsite area include passerines (e.g., snow bunting, Lapland longspurs); waterfowl such as geese, ducks and loons; raptors such as hawks, falcons, and owls; gulls and terns; cormorants; grouse; and cranes. Most of the bird species are transitory and are only seasonally present in the Portsite area, but pintail and widgeon ducks, and Canada geese are known to nest in the riparian habitat near the lagoons. Flocks of Canada geese, swans, and ducks have been observed migrating inland from the coast in the Portsite area during both spring and fall migrations. However, for the thousands of birds using the Chukchi Sea as a primary migratory route, specific routes have not been well documented for the spring and fall migrations. Regarding threatened and endangered birds, Steller’s eider and spectacled eider, the spectacled eider migration routes are 15 to 30 km offshore while the Steller’s eider migration routes are not well documented. The closest critical habitat for either one of these two species (spectacled eider) is at Ledyard Bay, which is about 100 miles from Portsite.

2.20 Cultural Resources

The Cape Krusenstern and Kivalina areas were part of Beringia during the late Pleistocene Era. Current archaeological theory believes this was the route people followed as they colonized the Americas about 12,000 years ago. The recovery of Pleistocene mammoth and mastodon tusk fragments from the floor of the Alaska continental shelf has strengthened the idea that people would have followed large grazing animals across the vast steppe tundra. The National Park Service and the Alaska State Historic Preservation Officer have determined that there is low probability of development for the tentatively recommended plan to adversely affect cultural resources. The topography of the area offshore of Portsite has yielded no cultural material of this age. A detailed explanation of cultural resources near Portsite can be found in the EIS.

There are two historic properties recorded at Portsite. NOA-00074 is George Onalik's Reindeer corral and camp. NOA-00307 is a grave and an ice cellar. Both sites are on the edge of the unnamed lagoon immediately south of the gravel pad at Portsite. NOA-00074 includes a cabin, tent sites, and a reindeer corral. In 1994, It was determined the cabin site, associated activity area, and the complex of chutes and fences for reindeer herding were gone. The string of corral posts on the barrier bar, the remains of an historic midden, the grave, and the ice cellar are all that remain of the site. The site did not appear to contain enough integrity to warrant placement on the National Register of Historic Places". The NOA-00307 site is intact and eligible for the National Register of Historic Places.

2.21. Subsistence

2.21.1 Introduction

Subsistence is defined as the non-commercial hunting, fishing, and gathering of wild renewable resources for direct personal or family consumption as food, shelter, fuel, clothing, tools, and handicrafts, and for trade, barter, or sharing. Subsistence harvests may be authorized by Federal regulations or State permits for personal use, sport hunting, sport fishing, or trapping, or may be based in some other regulation or custom. Besides the use of traditional ecological knowledge, subsistence information comes from multiple other sources, including subsistence data gathered by state, federal, and other agencies, hunters' reports to agencies, and from conversations with the people of northwestern Alaska. The subsistence resources of interest were either (1) identified as important during the draft EIS scoping process, (2) considered to have special cultural significance to the people, or (3) are likely to be directly affected by any expansion of the DMT loading facilities. Subsistence resources in the Portsite area that are of special interest are listed in table 14.

Table 14. Subsistence Resources of Special Interest

Marine Mammals	Fish	Birds	Terrestrial Mammals
Bearded Seal	Char	Ducks	Caribou
Walrus	Grayling	Geese	Moose
Beluga Whale	Salmon	Ptarmigan	Dall Sheep
Bowhead Whale	Whitefish		
Ringed Seal	Cod		
Polar Bear			

The following paragraphs describe subsistence species that may be affected by a possible project. They include Native American views regarding the potential impacts to the harvesting of subsistence resources as well as harvest numbers for the above species of special interest.

2.21.1.1. Beluga Whale

According to Native hunters, the summer after the dock and trestle at Portsite was built, not one beluga whale migrated along the shoreline in the summer. This theme is repeated by the traditional knowledge in the villages of northwestern Alaska and the Chukotka Peninsula that beluga whales are sensitive to noise and, consequently, the noise from the existing operations of the DMT forces the whales to move out to sea, rather than follow the shoreline past Portsite and Kivalina. Data collected about the beluga whale harvest since the 1987–1988 season indicates that Kivalina hunters have shifted their prime harvest of belugas from the summer stock (Eastern Chukchi Sea) to the spring stock (Beaufort Sea).

2.21.1.2. Bowhead Whale

In proximity to Portsite, very few bowhead whales are harvested for subsistence: Kivalina hunters harvested only three bowheads between 1991 and 2002. Traditional knowledge also believes that bowhead whales are sensitive to noise, and Native hunters are very careful about making any noise when hunting bowheads.

2.21.1.3. Polar bear

Alaska Natives are the only U.S. citizens authorized by the Federal Government to kill polar bears for subsistence. Polar bears are usually taken when the hunters are seeking beluga and bowhead whales. The skins and hair of polar bears are used in Native culture for clothing, crafts, and artwork. The mean harvest of the Chukchi Sea stock of polar bears was 49 per year from 1996 to 2000.

2.21.1.4 Bearded and Ringed Seals

According to traditional knowledge, ringed seals continue to be an important subsistence species but have lost some of their importance as a subsistence resource. Most of the traditional uses of the ringed seal have been taken over by modern goods and the snow machine. However, they still are important as meat for Native hunters while living in subsistence camps for extended stays. Bearded seals have surpassed ringed seals in the amount and importance as a subsistence resource. They are five times heavier than a ringed seal, and thus, make a greater dietary contribution to Alaska Natives. Bearded seals also are used for seal oil, which is used for dietary and trading purposes with other communities. During the 1991–1992 harvest, Kivalina hunters took 139 bearded and 110 ringed seals.

2.21.1.5. Pacific Walrus

Native hunters harvest few Pacific walrus in the Portsite and Kivalina areas. Because most of the walrus are far offshore, Native hunters may travel 30 to 40 miles to harvest them and have been known to travel as far as 300 miles. The walrus is used for its meat, its ivory tusks for artwork, and its tough skin for traditional skin boats. Since the 1998–1999 harvest season, Kivalina hunters have taken 15 walruses.

2.21.1.6 Fish

The subsistence harvest statistics show that the vast majority of fish taken by Kivalina residents are Dolly Varden char. Other important subsistence species are saffron cod, salmon, whitefish, and Arctic grayling. Salmon, char, and whitefish are usually caught with gillnets or seine nets while Arctic grayling and saffron cod are caught with hook and line. Fish caught for subsistence are either frozen, dried, or cooked and eaten fresh. During the 1991–1992 subsistence harvest, about 70,000 pounds of Dolly Varden char, 6,000 pounds of cod, 5,000 pounds of salmon, and about 4,600 pounds of whitefish were taken. Only about 650 pounds of Arctic grayling were taken during this same harvest period.

2.21.1.7 Terrestrial Mammals

Caribou, moose, and Dall sheep are the predominant terrestrial mammals hunted for subsistence. Caribou are harvested year round, but most are taken during the migration in the fall when they come near the Kivalina and Portsite areas. Caribou are taken in the greatest numbers, and the average family in Kivalina needs 12 caribou in support of their dietary requirements. During the 1991–1992 harvest season, Kivalina hunters took 351 caribou. Moose are usually taken in the fall and winter when they congregate around the riverbanks. Moose fat is sometimes mixed with berries in the diets of Alaska Natives. Though moose are much larger than caribou, far fewer moose are taken (17 during the 1991–1992 season) in general because caribou meat is preferred over moose meat. Dall sheep, which are found in the DeLong and Baird mountains, are usually taken when hunters are fishing for char. However, very few Dall sheep are taken for subsistence with none being taken in the 1991–1992 season.

2.21.1.8 Birds

Ducks, geese (black brant), and sometimes swans are primary subsistence birds in the Portsite area. Both the adult birds and eggs are eaten. Ptarmigan are also taken in the fall, winter, and early spring. Birds are hunted with shotguns or rifles. Birds are preserved using traditional methods of freezing or cooking or are eaten fresh. During the 1991–1992 subsistence harvest season, Kivalina hunters took 944 geese, 609 ducks, and 637 ptarmigan.

2.21.2 Importance of Subsistence

Residents in the economic study area are strongly tied to subsistence gathering, and as such, depend on these resources to a great degree due to the economic conditions that prevail for many residents in northwestern Alaska. Especially for the residents of communities outside the more diversified economic hubs (Kotzebue, Nome and Barrow), high unemployment, low incomes and high rates of poverty persist. Subsequently, subsistence is a primary source of food for many people in the economic study area and is at the center of tradition and culture for many of the study area’s people.

Given the importance of subsistence to Alaska Natives, and other hunters, fishers, and gatherers, the vast majority of the terrestrial plants and animals harvested for personal use in northwestern Alaska would not be adversely affected by navigation improvements because a project would be constructed almost entirely in the Chukchi Sea. For potential impacts to some marine mammals and invertebrates, please refer to the Section 5 for summary information and the DEIS for the detailed analysis of potential environment impacts in the area around Portsite.

3.0 PLAN FORMULATION

3.1. Purpose of Section 3

The purpose of this section and the following section is to summarize steps 3, 4, 5, and 6 of the planning process that was used for the DeLong Mountain Terminal Navigation Improvements, Alaska, IFS. The general plan formulation and evaluation process was discussed in Section 1.10. This section provides background information, identifies the without project condition, covers the planning undertaken in Planning Steps 3 through 5, and also covers Phase 1 and Phase 2 Formulation, including the initial identification of concentrate movement measures, their evaluation, screening and creation of alternatives, similar information for fuel movement measures, and the identification of mitigation options. Twelve candidate alternatives are screened down to a final list of four detailed alternatives. Section 4 covers Phase 3 Formulation and provides a summary of the reformulation, evaluation, and comparison of detailed alternatives, including the rationale for the identification and designation of “plans” and the selection of a plan as the tentatively recommended plan.

3.2. Problems and Opportunities

Problems have been identified with the continued operation of the existing port facility. With the completion of the recent Value Improvement Program, the existing DMT infrastructure and lightering barge system is at or near its capacity. AIDEA is concerned that the existing system will not reliably handle the current planned annual throughput of 1,544,000 swt of concentrate in years with worse than average weather conditions. The current system for loading concentrates is a relatively high cost operation when compared with direct-load options. Also, leaving concentrate in the concentrate storage buildings at the end of the shipping season could have a significant adverse impact on expected revenues, especially if TCAK has already sold that material. TCAK needs to be able to meet the requirements of prearranged sales. If the stored material was not sold, the economic impact would be less. In addition, there currently is limited spare capacity for the existing port infrastructure to handle cargos for other potential projects in northwest Alaska. Improvement of the existing port facilities could help DMT realize opportunities currently not achievable. Improvements should reduce the risk of future barge damages and fuel and/or concentrate spillage. The environment could realize a benefit through the elimination of double handling of concentrates over water and a reduction in the number of marine transits through the elimination of the intensive barge lightering operation. Regional benefits could accrue by providing port capacity for additional resource development at incremental and not total cost. An improved DMT could facilitate the development of a more economical regional fuel system. If direct importation of fuel from international markets by deep-sea tanker could be achieved, an operating cost savings at DMT and for regional fuel users could be realized.

3.3. Planning Objectives

3.3.1. NED Planning Objectives

The Federal Planning Objective, as stated in the Water Resources Council's Economic and Environmental Principles and Guidelines for Water and Related Land Resources Implementation Studies of March 1983 (P&G), is "to contribute to national economic development consistent with protecting the Nation's environment, pursuant to environmental statutes, applicable executive orders, and other Federal planning requirements." For the DeLong study, the study specific NED objectives include the following:

- Facilitate the further development and advance the general prosperity and economic welfare of the Nation's economy by increasing the efficiency of the water transportation system for the concentrates from the Red Dog Mine.
- Improve the capability and safety of and reduce the costs of DMT to handle both exports and imports of petroleum products.
- Improve the delivery and reduce the costs of general goods and services to the residents of northwestern Alaska.

3.3.2. Other Planning Objectives

In addition to the NED Planning Objectives, there usually are other important objectives for a water resources project. These often have an environmental and/or regional development nature. The non-NED planning objectives for the DeLong Mountain Terminal Navigation Improvements IFS have been identified as follows:

- Increase the capability and safety of DMT by reducing the current risk of concentrate spills, fuel leakage and spills, barge and ship damages, and total overall marine transits.
- Reduce environmental risks, protecting the sensitive arctic environment, minimizing cultural impacts, and mitigating significant project impacts where reasonable.
- Reduce regional transportation costs, further developing DMT as an element of the DMTS for the DeLong Zinc Belt to handle additional imports and exports from future development activities (most likely expanded or additional zinc/lead mine(s), copper mine(s), and/or coal mine(s) exports and imports of mining materials, fuel and petroleum products, and other supplies for northwest Alaska).
- Provide port service to reduce the regional cost of living and support other future northwest Alaska development.

3.4. Planning Constraints

Planning constraints respond to concerns that need to be completely avoided, minimized, or fully considered in developing alternative solutions to problems. The primary constraints in planning a modification of Portsite include the following:

- Avoid any significant interruption in the existing barge lightering operation through the end of the construction period for an improved facility.
- Design all improvements to accommodate severe arctic conditions.
- Retain the current material transportation mode (bulk base metal concentrate) because of constraints on the materials handling system of the customer.

- Accommodate a range of bulk vessels from Handysize to Panamax class to enable TCAK to continue to economically supply its customers in North America, Asia, and Europe.
- Avoid adversely affecting the physical environment of Cape Krusenstern National Monument.
- Avoid adversely affecting the environment and resources on lands controlled by NANA, the Northwest Arctic Borough, and nearby cities and villages.
- Avoid or minimize significant adverse impacts to fish and wildlife habitat in the Portsite area.
- Do not adversely affect the existing subsistence activities and the Native Alaska culture that rely on subsistence activities.
- Meet the minimum investment criteria for Alaska Industrial Development & Export Authority (AIDEA).
- Maintain capital, and operation and maintenance costs within the local sponsor's financing capability, including any private, local, state, and/or federal contributions.

3.5. Evaluation Criteria

A number of evaluation criteria will be considered to screen and evaluate alternative plans and to measure each plan's contribution to the NED, Environmental Quality (EQ), Regional Economic Development (RED), and Other Social Effects (OSE) accounts. The alternative plan shown to maximize net NED benefits will be identified as the NED plan. A locally preferred plan also may be identified. The recommended plan is usually the NED plan. If certain criteria are met, the locally preferred or a hybrid plan may be the recommended plan. The NED, locally preferred (if desired), and recommended plan (if different) will be developed to the same level of design and cost estimates for valid comparisons to be made. Engineering for the recommended plan will be sufficiently detailed and complete in this study for the project to proceed directly to preparation of plans and specifications under a design agreement with the local sponsor.

The **evaluation criteria** identified under Principles and Guidelines (P&G) are the following:

Completeness. The extent to which an alternative plan provides and accounts for all necessary investments or other actions to ensure the realization of all planned effects. (Does the plan include all the elements needed to achieve the identified benefits?)

Effectiveness. The extent to which an alternative plan alleviates the specified problems and achieves the specified opportunities, as established in the planning objectives. (To what extent does the plan provide the desired outputs?)

Efficiency. The extent to which an alternative plan is the most cost-effective means of alleviating the specified problems and realizing the specified opportunities as established in the planning objectives, consistent with protecting the Nation's environment. (Does the plan provide the maximum net NED benefits?)

Acceptability. The workability and viability of the alternative plan with respect to acceptance by state and local entities, and the public, and compatibility with existing laws, regulations, and public policies. (Is the plan feasible [in technical, environmental, economic, and social senses] and doable [in political, legal, institutional senses]? To what extent is the plan, while maybe not ideal, satisfactory?)

3.6. System of Accounts

The System of Accounts is a way to organize and keep track of the effects of alternative plans. The accounts established by the P&G include NED, EQ, RED, and OSE. These accounts will be used for the detailed evaluation of alternatives during Phase 3 Formulation along with technical criteria. Criteria adopted for use in this study to more clearly differentiate between the outputs and impacts for various plans and alternatives during Phase 3 of the process are the following:

3.7. National Economic Development Account

- Increase efficiency and capability, and reduce transportation costs for the export of base metal concentrates.
- Increase efficiency and reduce transportation costs for the import of fuel and general cargo for the Red Dog Mine/DMTS.
- Provide the potential for reduced costs through improved delivery of fuel, general goods, and services to the western and northern arctic.
- Improve safety at Portsite.

3.8. Environmental Quality Account

- Reduce the risk of fuel and concentrate leakage and spills, and other marine accidents.
- Reduce overall total marine transits per volume of material.
- Minimize significant impacts to marine biological resources of particular concern.
- Minimize potential disruptions caused by Portsite land and marine operations.
- Reduce potential for dust emissions and spillage of concentrate over water.
- Minimize significant adverse effects due to dredging of bottom materials.
- Minimize blockage of littoral drift.
- Minimize significant adverse dredged material disposal effects.
- Protect the sensitive arctic environment and mitigate significant project impacts where reasonable.
- Develop environmentally acceptable construction and maintenance methods.

3.9. Regional Economic Development Account

- Provide improved transportation service to the northwestern Alaska coastal area.
- Provide capability for future expansion of Portsite when additional commodity movement becomes economically viable.
- Increase the safety of Portsite in handling increased throughputs of base metal concentrates, fuel, and general cargos.
- Reduce the regional cost of living through reductions in fuel shipping costs.

- Reduce the regional cost of living through reductions in cargo shipping costs
- Provide/maintain good paying jobs for region residents.

3.10. Other Social Effects Account

- Minimize adverse impacts to existing subsistence hunting, fishing, and harvesting activities of residents.

3.11. Technical Criteria

- Provide technically appropriate, bulk material handling systems with sufficient loading capacity for planned zinc and lead concentrate throughputs.
- Provide a design that meets the site-specific criteria of severe winter ice conditions and a short open-water period with unsheltered sea conditions, while maximizing facility operational reliability and ease of maintenance.
- Avoid any significant restriction on the existing Portsite operations during construction.
- Avoid reducing the usable shipping season.
- Minimize weather-induced downtime sufficiently to achieve annual throughput requirements.
- Provide for expandability suitable for multiple future regional users.
- Provide sufficient capacity for offloading fuel, general cargo, and consumables.
- Provide large vehicle access to the dock structure.

3.12. Without-Project Condition (No-Action Plan)

The Without-Project Condition is the alternative future likely to occur in the absence of any public (non-federal or federal) attempt to respond to the planning objectives. The existing condition is projected to the base year (the year a project would become operational, producing NED benefits) and then extended through the end of the planning period. Thus, it covers the time of planning, design, construction, and a 50-year economic life for operation and maintenance. The Without-Project Condition is the same as the “No-Action Plan” for NEPA purposes. In general, the Without-Project Condition will be the same as the existing conditions described in Section 2. The existing port facility is expected to remain as it currently is configured. For this study, the selected project base year is 2011. The commodity projection to be used in the study will center on an expectation of 1,544,000 swt annually as the probable or most likely future condition. The economic analysis period extends from 2011 to 2061. Based on the vessel simulation model, there is expected to be about 37 weather days at Portsite annually that would interrupt lightering barge operations, resulting in a combined total delay queue time for the bulk carriers of 308 ship-days. The sponsor’s consultant estimates that, based on the hindcast and other hydraulic analyses, Portsite would be able to meet its commodity projections about 71 percent of the time in the future.

The without-project condition for fuel oil is the use of an ocean going barge. Current practice each shipping season is to fully load the barge in Puget Sound, Washington. Then travel to Kotzebue to offload about a million gallons. This lightens the barge enough to allow the barge to offload the balance, a 4,250,000-gallon load, at DMT. Subsequent visits each season are similar, except that the barge usually reloads near Kenai, Alaska, rather than returning to Puget Sound for each load. This procedure would use six barge loads to deliver the annual 7,750,000 gallons needed at Kotzebue, plus the 22,360,000 gallons needed at Portsite.

3.13. Overall Formulation Strategy

The rest of Section 3 is devoted to first identifying, developing, and evaluating single purpose measures that facilitate improvements in the export of base metal concentrates from DMT and then combining the best of those measures into single purpose alternatives. Single purpose improvement alternatives will likewise be created for fuel transfer facilities. Then the remaining single purpose measures/alternatives will be combined, evaluated, and compared to form alternatives that address the planning objectives for both base metal concentrate and fuel movements, and, if possible, general cargo handling. The initial measures will be developed, evaluated, and screened to remove those that clearly will not work, will not meet the planning objectives, or are clearly inferior to other similar options in regards to completeness, effectiveness, efficiency, and acceptability. Alternatives will then be developed from combinations of measures, evaluated and compared. Each of those alternatives then will be refined to include consideration and accommodation of the additional objectives of better handling of fuel and general cargos.

3.14. Screening of Concentrate Movement Measures

There are three general measure development strategies to consider in improving the marine transportation for concentrate movement currently provided by DMT. These include the following measures: (1) Create or use another port somewhere in the northwest or central Alaska to better transport Red Dog Mine base metal concentrate; (2) Develop a new mode for the material movement from DMT with its associated necessary facilities; or (3) Provide structural and/or non-structural improvements at DMT, retaining the mode of moving the material in bulk, powdered, concentrate form.

3.14.1. Alternative Port Sites.

The original Red Dog Mine Environmental Impact Statement (EIS) in 1984 looked at port sites at Singoalik Lagoon, Tugak Lagoon, and VABM 17, in addition to the site selected for Portsite at VABM 28. The Northwest Arctic Regional Transportation Analysis by the Alaska Department of Transportation and Public Facilities in 2001 identified eight potential tidewater port sites, including the existing DMT, to possibly serve for transportation of the natural resources from northern Alaska and the northwest arctic. The other seven sites include Omalik Lagoon, Kotzebue/Cape Blossom, Port Clarence, Cape Nome, Cape Darby, Tyonek/Foreland, and Seward. Other existing deep-draft ports in Southcentral Alaska include: Port MacKenzie, Anchorage, and Seward. The Matanuska-Susitna Borough has recently finished work on a deep-water dock for their Port MacKenzie facility, with the first user in 2005 being a wood chip exporter. The Port of Anchorage currently operates a deep-water port, primarily for containers, general cargo, and fuel. The Port of Whittier also provides deep-draft facilities in Southcentral Alaska. Figure 19 shows the location of these sites.

Besides providing new port facilities, an overland transportation route, which would involve a large number of bridges and river crossings, would need to be developed to get concentrate from Red Dog Mine to a new port site. To reach a new port at Nome from Portsite, about 600 miles of new, heavy-duty road/railroad would be required. In addition, many miles of existing road would have to be improved to accommodate the heavy, concentrate trucks and trailers. Since each of the new port sites would require construction of substantial transportation infrastructure in addition to whatever port facilities might be required, all the other port sites are clearly not economically or financially efficient when their potential costs for both road and port improvements are compared with the cost of port improvements alone at DMT. Their respective environmental effects would be spread over a larger portion of Alaska than with DMT improvements. They would open northwestern Alaska to greatly improved access for both residents and visitors, which could lead to social change contrary to traditional values. Therefore, all alternative port sites were screened out from further consideration in this feasibility study.

3.14.2. Alternative Modes of Transport

The current mode for the transportation of the base metals from mill to smelter is as powdered concentrate in bulk mode. Other possible modes, investigated prior to the construction of Red Dog Mine, include: loading concentrate into containers, using a LASH system, changing the concentrate to a slurry mixture, producing electronic zinc, or using ice-strengthened vessels.

3.14.2.1. Shipping Containers

Loading the concentrate into shipping containers at the mine and moving the containers to smelters worldwide would require the purchase of specialized shipping containers to carry the powdered concentrate, modified from the standard design to facilitate concentrate loading, transportation, and unloading. Using container ships would require either developing a modified lightering barge operation to move the containers to the container ships offshore or construction of a deep-water container dock similar to that being considered for the bulk concentrate movement. Concentrate purchasers would need to modify their import facilities to unload and handle containers. This change would be very capital intensive. There is no compelling reason for concentrate purchasers to change their mode just to receive Red Dog Mine concentrate, since they are able to obtain their smelter needs off the worldwide open market from other sources. This mode of transport was eliminated from further consideration.

Figure 19. Alternate port sites

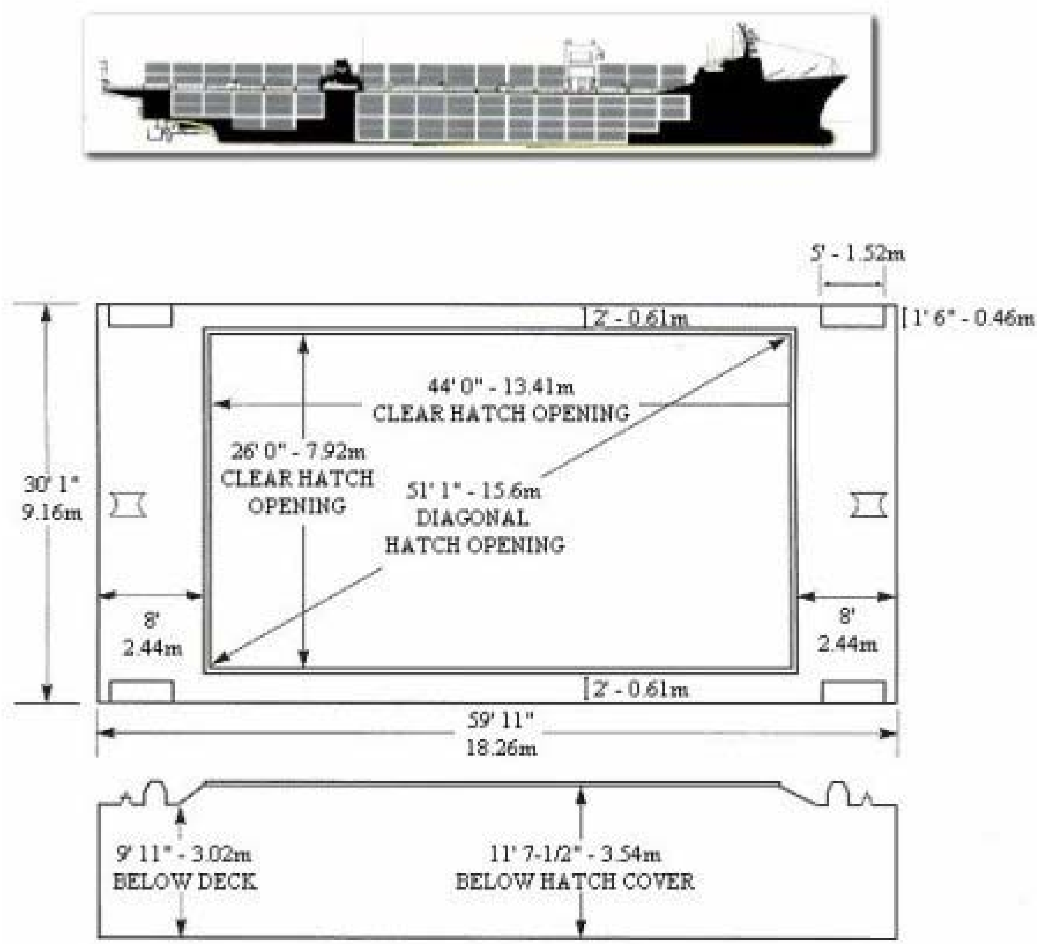

Figure 20. Lighter Aboard Ship (LASH)

3.14.2.2 LASH

A Lighter Aboard Ship (LASH) system (figure 20) employs small barges that are loaded onto and then transported on ocean-going ships. LASH ships have a standard design, being about 893 feet long with a beam of 100 feet and a draft of 41 feet. Each 48,000-long-ton ship has a 500-ton capacity traveling crane to lift the barges onboard and off. The barges are standardized at about 30 by 60 feet with a 13-foot depth and a bulk material carrying capacity of 385 tons. Each ship can carry 89 standard barges. The barges are stowed on five “floors” or levels on the ship. In order to move the desired concentrate throughput during the short shipping season, 46 vessels would be needed (ship capacity of product is 34,265 dwt), which is about double the number of ship visits required under the existing port procedures. Also, the standard LASH barges are designed for use only in sheltered ports and along rivers. They can’t be towed on “open waters,” such as lakes and open sea. The use of a LASH system at Portsite would be much less efficient than the current operation and require many more vessel transits. This mode of transport was screened out from further consideration.

3.14.2.3. Slurry

Another measure considered involved transforming the concentrate into a slurry mixture to move it from the shore to the dock in a slurry pipeline, buried under the seabed or placed on a trestle from the shore to a dock or a moorage for the bulk carrier. A slurry plant would need to be constructed at the Concentrate Storage Buildings and a dewatering system installed either on a dock (either permanent or movable) or on the bulk carriers. The technology for a marine dewatering system is not currently developed and readily available. Onboard systems might need to be installed on a number of bulk ships, which would result in a much more limited available fleet compared to the current operation that obtains bulk carriers off the open spot market. Return water would flow in a second pipeline back to the slurry plant on shore for recycling and reuse. The watering/dewatering system would probably have relatively high maintenance costs with an unpredictable efficiency in the arctic area. There could be significant environmental concerns over possible slurry releases to the ocean. This mode of transport was screened out from further consideration.

3.14.2.4. Electrolytic Produced Zinc

Mine-site production of metallic zinc and lead at Red Dog, rather than the milling and transportation of base metal concentrates, could significantly reduce the volume and weight of material to be loaded onto ocean-going vessels and shipped from DMT. Conventional smelting at Red Dog is not feasible but electrolytic processes might be feasible if sufficient electricity could be produced cleanly and inexpensively. Given the existing generation process of burning diesel fuel in turbines, this is not viable at this time. If large amounts of economical electrical generation become available in the future, the electrolytic process might be economical for Red Dog. However, there are no current plans being developed for direct, on-site production of zinc or lead at Red Dog.

3.14.2.5. Ice-Strengthened Vessels

The number of days base metal concentrate could be loaded each year could be increased by using ice-strengthened vessels. This could enable more concentrate to be transported per season, extending the season from May to December. On-land storage requirements could be reduced somewhat. However, an earlier shipping season would impact subsistence hunting. There are a limited number of ice-strengthened bulk vessels available for charter, and the current tugs and barges used for lightering would have to be substantially modified to allow port operations past the beginning of November. Ice buildup on the bow of lightering barges would dramatically increase resistance, requiring additional horsepower and cost. The benefits would not be predictable, since all production is currently sold each year, so extension of the season might not result in any additional revenues. This option was rejected because it would not significantly address the planning objectives at a reasonable cost.

3.14.3. Development and Screening of Concentrate Measures

Improvements to the existing DMT concentrate movement operations can be divided into two general categories of measures: (1) improvements to the lightering system alone and (2) construction of a new, direct load, deep-draft facility. The development of measures for a direct-load, deep-draft facility can be further divided into three groupings: (1) the means of transport of concentrate from shore to a deep-draft dock, (2) the dock and berthing structure itself, and (3) the dredging and dredged material disposal required, if any, to accommodate the size and location of the dock.

3.14.3.1 Improvements to the Barge Lightering System

Twenty measures were considered to either improve the efficiency of the existing barge-based system or to expand it to better handle concentrate throughput. These measures include keeping the barge lightering concept but changing the transshipment methods, improving the existing barge system using various combinations of adding an additional barge loader and/or additional lightering barges, and placing a breakwater to shelter the barge loading operation. Table 15 lists the possible modifications of the barge-based lightering system that have been considered. The table lists an initial qualitative assessment of the potential of each of the measures in regard to the primary evaluation criteria identified earlier in this section. Only those measures identified in **boldface** in table 15 are being retained for further consideration in this feasibility study.

Table 15. Barge-Based Lightering Measures

Measure	Description	Completeness	Effectiveness	Efficiency	Acceptability
B1	Use Surplus Oil Tanker as Offshore Island with Modified Lighterer(s)	YES	NO	NO	NO
B2	**Single Bargeloader (existing system) with Third Lightering Barge**	**YES**	**YES**	**MAYBE**	**YES**
B3	Second Bargeloader with Third Lightering Barge	-	-	-	-
B3a	Second Bargeloader in Twin Facility to North of North Lagoon	Not needed	NO	NO	YES
B3b	Second Bargeloader on Same Alignment as North Trestle	Not needed	NO	NO	YES
B3c	Second Bargeloader in-Line with Existing Barge Facility	-	-	-	-
B3c(i)	New Conveyor to North of Existing Conveyor	Not needed	NO	NO	YES
B3c(ii)	New Conveyor “Piggy-Back” Over Existing Conveyor	Not needed	NO	NO	YES
B3c(iii)	New Conveyor to South of Existing Conveyor	Not needed	NO	NO	YES
B3d	Second Bargeloader Perpendicular to Existing Facility	Not needed	NO	NO	YES
B3e	Second Bargeloader South of Existing Barge Facility	Not needed	NO	NO	YES
B4	Second Bargeloader with Fourth Lightering Barge	Not needed	NO	NO	YES
B5	Second Bargeloader with Fifth Lightering Barge	Not needed	NO	NO	YES
B6	Extend Existing Trestle/Gallery to Serve Ocean Going Barges	NO	NO	NO	YES
B7	**Add Detached Rock Breakwater to Shield Existing Barge Facility**	**YES**	**YES**	**MAYBE**	**YES**
B8	Add Rock Causeway to Shield Existing Portsite Facility	-	-	-	-
B8a	Add Rock Causeway	NO	NO	NO	NO
B8a	Add Rock Causeway with Bridge Openings	NO	NO	NO	NO
B8b	Add Rock Causeway w/ Bridge Openings and Ice Benches	YES	YES	NO	NO
B9	Add Cellular Sheetpile Causeway to Shield Existing Facility	NO	YES	NO	NO

3.14.3.2 Measures to Move Concentrate from Shore to Deep-Draft Dock

Twenty different measures were considered for moving base metal concentrate from the surge bin near the Personnel Accommodations Complex to an offshore deep-draft dock in the initial stage of the feasibility study. Table 16 lists the measures considered for moving the concentrate from the shore to a dock or an island loading facility. The table lists a qualitative assessment of the potential of each of the measures in regard to the primary evaluation criteria identified earlier in this section. Only those measures identified in **boldface** in table 16 are being retained for further consideration in this feasibility study.

Table 16. Measures for Moving Concentrate from Shore to Deep-Draft Dock

Measure	Description	Completeness	Effectiveness	Efficiency	Acceptability
C1	Causeway with Enclosed Conveyer(s)	-	-	-	-
C1a	Rock Causeway	NO	NO	NO	NO
C1b	Rock Causeway with Bridge Openings	NO	NO	NO	NO
C1c	Rock Causeway w/Bridge Openings & Ice Benches	YES	YES	NO	NO
C1d	Lower Rock Causeway with Openings, Benches, and Raised Trestle	YES	YES	NO	NO
C1e	Cellular Sheetpile Causeway	NO	NO	NO	NO
C1f	Concrete Caisson Causeway	NO	NO	NO	NO
C2	Trestle to Carry Enclosed Conveyor(s)	-	-	-	-
C2a	Short-Span Trestle (50 to 150 ft) with Enclosed Conveyor(s)	YES	YES	NO	YES
C2b	Medium-Span Trestle (150 to 400 ft) with Enclosed Conveyor(s)	-	-	-	-
C2b(i)	Segmental Precast Concrete Trestle	YES	NO	NO	YES
C2b(ii)	Steel Girder Trestle	YES	NO	NO	YES
C2b(iii)	**Steel Truss Trestle**	**YES**	**YES**	**MAYBE**	**YES**
C3	Cable Stayed Gallery (400 to 800 ft spans) Supporting Enclosed Conveyor(s)	NO	MAYBE	MAYBE	YES
C4	Aerial Tramway (800 to 1,000 ft spans) for Concentrate	NO	NO	NO	NO
C5	Tunnel	-	-	-	-
C5a	Small-Bore Tunnel (10 ft diameter)	NO	NO	NO	NO
C5b	**Medium-Bore Tunnel (14 ft diameter)**	**YES**	**MAYBE**	**MAYBE**	**MAYBE**
C5c	Large-bore Tunnel (20 ft diameter)	YES	MAYBE	NO	YES
C5d	Prefabricated Steel/Concrete Tube	YES	MAYBE	NO	YES

3.14.3.3 Measures for Deep-Draft Dock and Berthing Structure

Twenty-one different measures were considered for the deep-draft dock in the initial stage of the feasibility study. Table 17 lists the measures considered for the dock and berthing area portion of a new facility for the direct loading of deep-draft vessels. The table lists a qualitative assessment of the potential of each of the measures in regard to the primary evaluation criteria identified earlier in this section. Only those measures identified in **boldface** in table 17 are being retained for further consideration in this feasibility study.

Table 17. Draft Dock And Berthing Structure Measures

Measure	Description	Completeness	Effectiveness	Efficiency	Acceptability
D1	Spread Mooring System	-	-	-	-
D1a	**Mooring Buoys**	**YES**	**YES**	**MAYBE**	**YES**
D1b	**Dolphins**	**YES**	**YES**	**MAYBE**	**YES**
D2	Dock Structure	-	-	-	-
D2a	Stick-Built Structure	YES	YES	NO	YES
D2b	**Prefabricated Jackup Structure**	**YES**	**YES**	**MAYBE**	**YES**
D2c	Cellular Sheetpile Cells	NO	NO	NO	NO
D2d	Precast Concrete Caisson	NO	NO	NO	NO
D3	Dock/Trestle Support Structure	-	-	-	-
D3a	**Conical Piers**	**YES**	**YES**	**MAYBE**	**YES**
D3b	**Monopile Piers**	**YES**	**YES**	**MAYBE**	**YES**
D3c	Hybrid Monopile Pier	NO	NO	NO	YES
D3d	**Cellular Sheetpile Cells**	**YES**	**YES**	**MAYBE**	**YES**
D3e	Precast Concrete Caisson	NO	NO	NO	YES
D4	Loading Structure in Sheltered Lagoon	NO	NO	NO	NO
D5	Shiploader Options	-	-	-	-
D5a	Fixed Shiploader	NO	NO	NO	NO
D5b	**Fixed Radial Shiploader**	**YES**	**YES**	**MAYBE**	**YES**
D5c	Quadrant Shiploader	YES	MAYBE	NO	YES
D5d	Linear Shiploader	YES	MAYBE	NO	YES
D5e	Traveling Luffing Shiploader	YES	MAYBE	NO	YES

3.14.3.4 Measures for Dredging and Disposal of Dredged Material

Dredging and disposal operations require consideration of both short- and long-term management objectives. Compatibility must exist between the dredging equipment and techniques used for the excavation and transport of the materials and the management of them. The primary short-term objective is to construct and maintain channels for navigation needs. Long-term objectives concern the management and operation of the disposal area(s) to ensure their long-term use. There are a number of dredging methods employed by the Corps and industry in the United States, but not all are applicable to Portsite. Consideration was given to identify those measures that would be applicable in an open ocean environment. Table 18 lists dredging disposal measures considered. The table lists a qualitative assessment of the potential of each of the measures in regard to the primary evaluation criteria identified earlier in this section.

A detailed analysis of dredging options and dredged material disposal measures and alternatives is contained in the Dredged Material Disposal Site Study in Appendix 2 of the DEIS. As part of that analysis, a Zone of Siting Feasibility (ZSF) was determined for marine disposal options. The upland disposal options are discussed in the DEIS. Specific disposal sites were evaluated and compared. No upland sites considered were determined to be practical or acceptable. The marine ZSF is limited on the north by the nearby community of Kivalina and on the south by valuable habitat off the mouth of Rabbit Creek. Environmental factors required the ZSF to be further limited to the portion where the existing depth would be greater than 60 feet. Four candidate marine sites were compared and evaluated. The site directly off Portsite was determined to be the most appropriate site for a potential Ocean

Dredged Material Disposal Site (ODMDS) because of its lower direct impact to personal subsistence activities, its proximity to the potential dredged area, and existing activities that already somewhat reduce resident use of that area. No reasonable beneficial use measures were identified within the ZSF.

Alternatives plans will be developed from these measures. Only the measures identified in **boldface** in table 18 are being retained for further consideration in this feasibility study.

Table 18. Dredging and Disposal of Dredged Material

Measure	Description	Completeness	Effectiveness	Efficiency	Acceptability
E	Dredging/Disposal Measures	-	-	-	-
E1	**Hydraulic Hopper Dredge**	**YES**	**YES**	**MAYBE**	**YES**
E2	**Hydraulic Pipeline Cutterhead Dredge**	**MAYBE**	**MAYBE**	**NO**	**MAYBE**
E3	**Mechanical Clamshell Dredge**	**YES**	**YES**	**MAYBE**	**YES**
E4	**Mechanical Backhoe Dredge**	**YES**	**YES**	**MAYBE**	**YES**
E5	**Barge/Scow Discharge**	**YES**	**YES**	**MAYBE**	**YES**
E6	**Hopper Dredge Discharge**	**YES**	**MAYBE**	**YES**	**YES**
E7	**Pipeline Discharge**	**NO**	**NO**	**NO**	**YES**
F	Dredged Material Disposal Sites	–	–	–	–
F1	Offshore Ocean Disposal Sites	–	–	–	–
F1a	Offshore Disposal in Water > 60 Feet Deep	–	–	–	–
F1a(1)	Inshore Site off Imikruk Lagoon	YES	YES	MAYBE	NO
F1a(2)	**Inshore Site off Portsite**	**YES**	**YES**	**MAYBE**	**YES**
F1a(3)	Site 25 miles off Portsite	YES	YES	NO	NO
F1a(4)	Site 40 miles off Portsite	YES	YES	NO	NO
F1b	Offshore Disposal in Water <60 Feet Deep	NO	NO	NO	NO
F1c	Offshore Disposal at Nearest EPA Site (Nome)	YES	YES	NO	NO
F1d	Offshore Disposal Beyond Continental Shelf	YES	YES	NO	NO
F1e	Onshore Disposal on Portsite Shoreline	NO	YES	NO	NO
F2	Confined Disposal Sites	–	–	–	–
F2a	Confined Disposal in South Lagoon or others	NO	NO	MAYBE	NO
F2b	Confined Disposal in Upland Tundra Area	YES	YES	NO	NO
F2c	Disposal in DMTS Quarries (Borrow Pits)	YES	YES	NO	NO
F2d	Disposal at Red Dog Mine (backfill mine pit)	YES	YES	NO	NO
F3	Beneficial Use Sites	–	–	–	–
F3a	Reuse for Future Portsite Operations	NO	NO	NO	YES
F3b	Reuse for Relocated Kivalina Foundation Pad	NO	NO	NO	MAYBE
F3c	Reuse for Creating Freshwater Wetland	NO	NO	NO	NO

3.14.3.5 Summary of Initial Screening of Potential Concentrate Measures

The initial screening of potential concentrate measures was intended to weed-out measures that could not be complete, effective, efficient, and/or acceptable, or may be obviously inferior to other measures with similar outputs. This process has reduced the initial list of about 80 measures to about 15 that can either stand alone as an alternative or be combined with other measures to form alternatives. Table 19 lists the measures that passed the initial screening.

Table 19. Screened Concentrate Movement Measures to be Considered Further

B2	Single Bargeloader (existing system) with Third Lightering Barge
B7	Add Detached Rock Breakwater to Shield Existing Barge Facility
C2b(iii)	Medium-Span (150 to 400 ft) Steel Truss Trestle with Enclosed Conveyor(s)
C5b	Medium-Bore Tunnel (14 ft diameter)
D1a	Mooring Buoys
D1b	Dolphins
D2b	Prefabricated Jackup Dock Structure
D3a	Conical Piers (for dock or trestle)
D3b	Monopile Piers (for dock or trestle)
D3d	Cellular Sheetpile Cells (for trestle)
D5b	Fixed Radial Shiploader
E1	Hydraulic Hopper Dredge
E2	Hydraulic Pipeline Cutterhead Dredge
E3	Mechanical Clamshell Dredge
E4	Mechanical Backhoe Dredge
E5	Barge/Scow Discharge
E6	Hopper Dredge Discharge
E7	Pipeline Discharge
F1a(2)	Offshore Open-Water Disposal Seaward from the Dredged Channel

3.15. Considerations for Combining Concentrate Measures into Alternatives

In order to simplify the development of alternatives, a number of comparisons can be made to reduce the number of concentrate combinations to consider. These include (1) identification of stand-alone measures; (2) pier selection; (3) single versus dual shiploader; and (4) strategy for evaluating trestle/channel versus tunnel/channel. In addition, other factors that could have a bearing on alternative formulation are discussed such as general cargo considerations and the modification of the Portsite generating system.

3.15.1. No-Action Plan

The without-project condition will be considered as Alternative 1, The No-Action Plan.

3.15.2. Stand Alone Measures

Of the concentrate measures remaining from the initial screening, the two barge-oriented measures are essentially independent of other measures and can stand alone as alternatives with minor modifications, such as the addition of Measures D1a (Mooring Buoys) and D1b (Dolphins). Therefore, measure B2 (Single Barge Loader with Third Lightering Barge) will be designated Alternative 2 (Third Barge Alternative). Since this alternative has no significant new construction at Portsite associated with it, it will also be considered a "Non-Structural Plan." Measure B7 (Detached Rock Breakwater to Shield Existing Barge Facility) will be designated Alternative 3 (Breakwater Alternative). These two stand-alone measures (B2 and B7) can be combined into a single alternative. This alternative will be designated Alternative 4 (Third Barge and Breakwater Alternative).

3.15.3. Refinement of Trestle Design

There are several elements of the trestle design that are beyond the scope of a feasibility study to specifically define. These include the final design for the trestle and dock foundation piers and whether one or two shiploaders are appropriate. For the purposes of creating reasonable cost estimates for the feasibility comparison of alternatives, the following paragraphs provide a summary of the design considerations for each of these elements.

3.15.3.1. Pier Selection

The initial screening of measures reduced the potential pier types to three: conical piers, monopile piers, and cellular sheetpile cells (figure 21). Design questions in the choice between the conical or the monopile piers will require further study during the detailed design phase and is far beyond the scope of work identified for a feasibility study. Consequently, for the purposes of the feasibility study, the alternative designs and cost estimates will be based on using the conical piers in “deep-water” locations where needed for support of structures. The cellular sheetpile cells will be used where needed for support of structures in the “shallow-water" locations.

3.15.3.2. Single Versus Dual Shiploaders

In the initial screening of measures, the various types of shiploaders in use worldwide were reviewed and the fixed-radial shiploader was selected for further consideration in the feasibility study (figure 22). A single fixed-radial loader requires vessels to be warped to reach all hatches, whereas a dual shiploading system can reach all hatches of the largest Panamax vessel without warping. When analyzed over a life cycle, the costs for the single and the dual systems are similar, if demurrage charges and storage costs are not included. Therefore, considering terminal performance, both capital and operational costs, and operational and construction risks, the dual fixed-radial shiploaders will be used on all alternatives to develop comparable costs for the feasibility study. Consideration of a single or a dual shiploading system will be reassessed during detailed design and appropriate modifications may be made to the design.

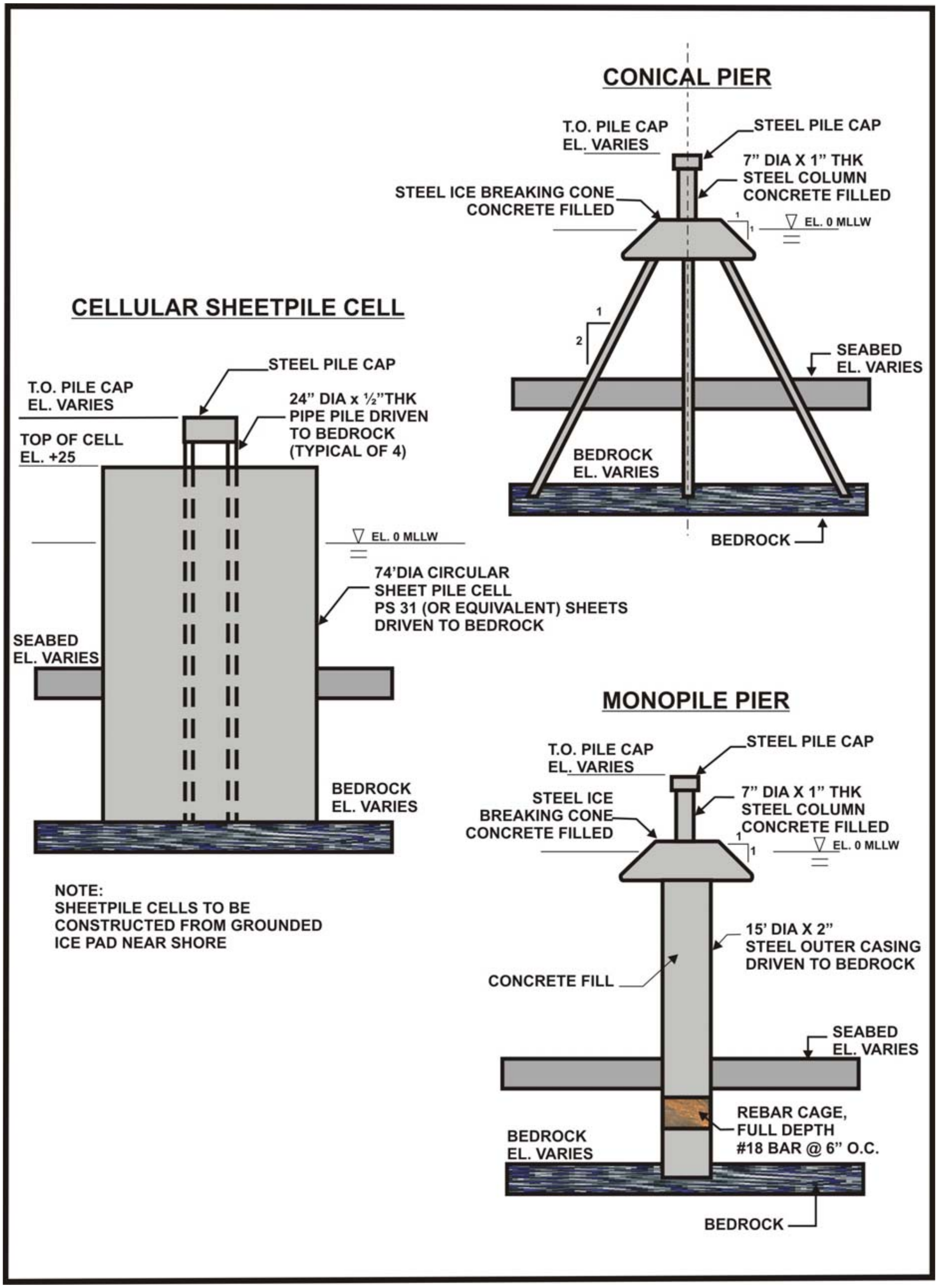

Figure 21. Dock trestle types

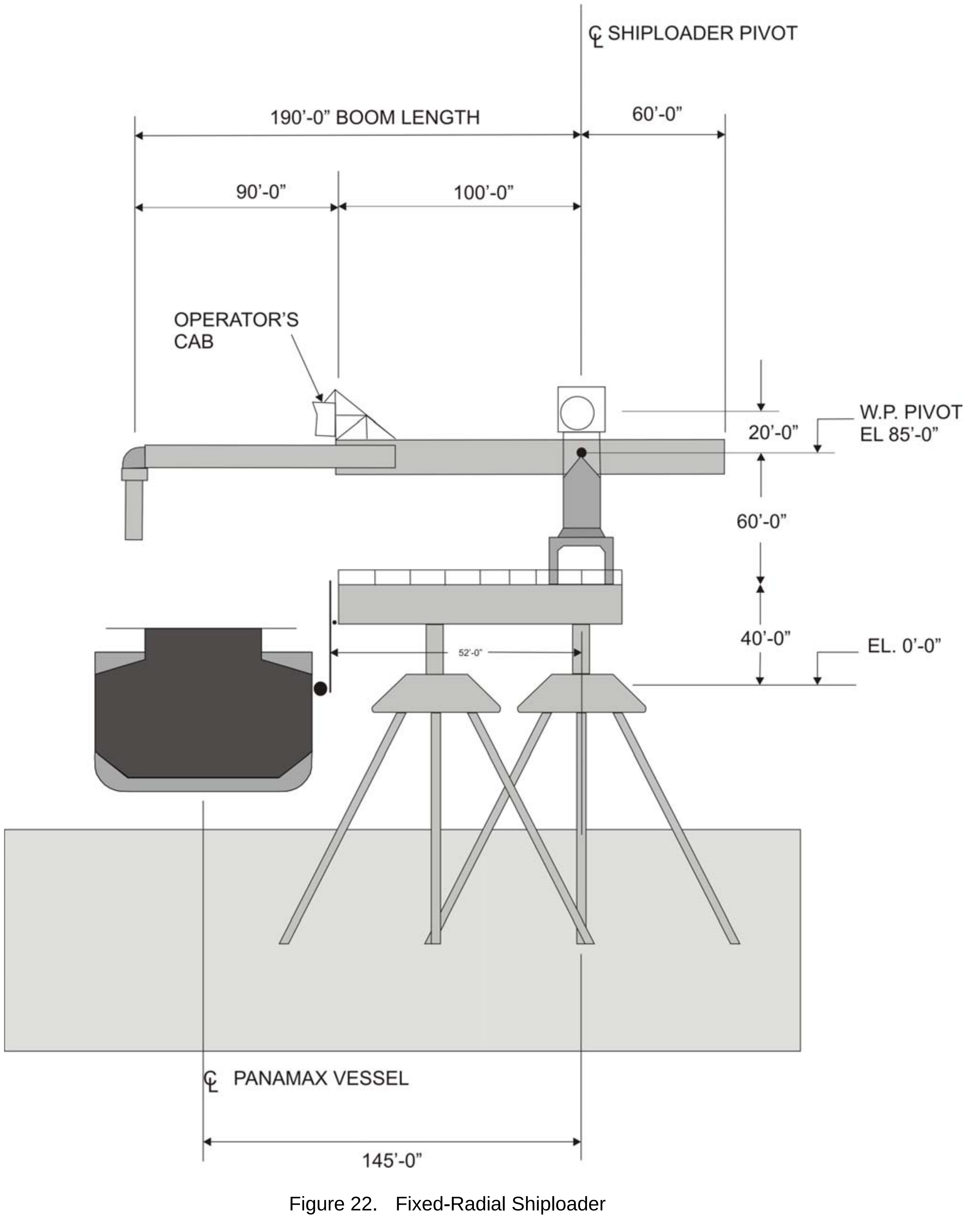

Figure 22. Fixed-Radial Shiploader

3.15.4. Strategy for Evaluation of Trestle-Channel and Tunnel-Channel Alternatives

Alternatives for a deep-draft dock to handle concentrate shipments will be developed by combining a number of measures to form complete plans. There are two generic deep-draft concentrate dock alternatives: (1) a trestle-dock-dredged channel alternative and (2) a tunnel-dock-dredged channel alternative. The trestle-dock-dredged channel alternative, designated Alternative 5, will be composed of various measures, marked in table 20 and referred to as the Trestle-Channel Alternative. In Phase 2 of the feasibility study it will be developed and optimized to determine the best combination of trestle and dredging. Different combinations of lengths of trestle, and depths and lengths of dredging will be analyzed. The tunnel-dock-dredged channel option (Alternative 6) will be composed of various measures, and referred to as the Tunnel-Channel Alternative. In Phase 2 the Tunnel-Channel Alternative will be compared with the Trestle-Channel Alternative to see if any cost savings could be achieved by using a tunnel. For the purposes of the evaluation and comparison phase of the feasibility study, a number of factors needed to be analyzed and determined to define design parameters for deep-draft channel alternatives. The following paragraphs discuss these parameters, including: the shipping season, the concentrate vessel fleet, benefit evaluation methodology, the channel and turning basin dimensions, the general alignment for the trestle/tunnel/channel, the deep-draft trestle alignment, general cargo considerations, and Portsite power generation considerations.

Table 20. Measures for Alternatives 5 and 6

Measure	Description	Alt 5	Alt 6
C2b(iii)	Steel truss trestle	x	
C5c	Large-bore tunnel		x
D1b	Dolphins	x	x
D2b	Prefabricated jackup dock	x	x
D3a	Conical piers	x	x
D3d	Cellular sheetpile cells	x	
D5b	Fixed radial shiploader	x	x
E1	Hydraulic hopper dredge	x	x
E2	Hydraulic pipeline cutterhead dredge	x	x
E3	Mechanical clamshell dredge	x	x
E4	Mechanical backhoe dredge	x	x
F1a	Offshore disposal seaward of channel	x	x

3.15.4.1. Shipping Season

The shipping season considered for the feasibility study and run in the simulation model was based on the historical start and end dates of shipping from the TCAK 1991-1999 DMT operating records and from ice coverage records in the Chukchi Sea and the Bering Strait for each year from 1961 to 2001. The early and late actual start and finish dates for DMT shipping have been, respectively, start: 4 July and 18 July; finish: 28 September and 1 November. Actual shipping seasons have ranged from 77 days to 110 days. Comparison of TCAK records with ice conditions indicated that the beginning of the shipping season occurs when the ice concentration is $0/10^{th}$, while an ice concentration of 2/10th corresponds with the end of the shipping season. In order to accommodate subsistence hunting, the season start is never set before July 4th. In years where the 0/10th ice concentration occurs between July

4th and 12th, the start date of operations is set for a date, within this period, plus three days. If it occurs after July 12th, the start is set for July 15th. If the 2/10th concentration occurs in November, the season is stopped one day before the concentration is observed.

3.15.4.2. Vessel Fleet

The vessel fleet is composed of two types of bulk carriers, a Panamax and a Handysize, and a fuel tanker. As explained in Appendix E, the Economic Analysis, a mix of Panamax and Handysize vessels is currently serving Portsite and would be expected to continue in the future, although the actual mix of vessels may change from year to year. For the study, the design vessels include the Panamax bulk carrier and the fuel tanker. A Panamax bulk carrier is defined as a 77,000-dwt vessel, 720 feet long and 105 feet wide, with a fully loaded draft of 45 feet. A Handysize bulk carrier is defined as a 44,000-dwt vessel, 632 feet long and 93 feet wide, with a fully loaded draft of 37 feet. The usual annual mix of vessels is about 3/4 Panamax and 1/4 Handysize. The design fuel tanker is defined as a 55,000-dwt vessel, 650 feet long and 107 feet wide, with a fully loaded draft of 40 feet.

3.15.4.3. Benefit Evaluation Methodology

In Appendix F, the Portsite Dynamic Simulation Model is discussed and its methodology explained. A probabilistic simulator was used to derive throughput capacity and vessel queuing for alternatives under consideration. The simulation model uses information on projected commodity levels, concentrate storage, building size, loading delays, fleet mix, fuel shipments, vessel maneuvering, meteorological conditions, and shipping season length. The ship queue time is the primary output that is used to determine economic benefits for each alternative. Benefits are generally equal to projected cost and/or transportation savings determined by comparing simulation runs for the without-project condition with those of the potential alternatives.

3.15.4.4. Channel and Turning Basin Dimensions

As discussed in Appendix A, Engineering and Design for General Navigation Features, approximate channel widths were developed by AMEC and then reviewed and modified by the Corps using guidance both from the Permanent International Association of Navigation Congresses (PIANC) and from the Corps. The ship simulator at the Corps Coastal and Hydraulics Laboratory then was used to finalize the channel design. Several unique conditions challenge the mariner at Portsite, including currents perpendicular to the dredged channel, adverse winds, and a short navigation season. Alaskan pilots and pilots from Florida with experience in cross-current vessel transit operated the ship simulator along with a marine consultant specializing in tug operations. The straight channel flares at its inshore end to an off-center turning basin. Because the prevailing current is to the north, the deep-draft dock would be placed on the south side of the channel. This north side berth allows the easier departure of loaded ships that was desired by the pilots.

The nominal channel (figure 23) used during Phase 1 and Phase 2 Formulation was based on a channel with a design depth of 53 feet. During Phase 3 Formulation an optimization analysis will be developed to determine the economically most efficient combination of channel length and depth and trestle or tunnel length. The 53-foot-deep channel, located on bearing of N72°38'27"E, is 500 feet wide at its seaward end (about 18,500 feet seaward of the –20-foot bottom contour). The channel gradually widens to 760 feet wide about 3,485 feet seaward of the –20-foot contour, where the northern portion of the channel further widens to 800 feet wide (total channel width is 1,180 feet) from about 2,210 feet to 1,710 feet seaward of the –20-foot contour (figure 24). From there the northern portion of the channel tapers to 242 feet wide at the –20-foot contour. The south portion of the channel tapers from 380 feet wide about 3,485 feet seaward of the –20-foot contour to 358 feet wide at the seaward end of the dock area. South of the channel, a turning basin is provided from 3,485 feet seaward of the dock area to the dock area that tapers from zero width at its seaward and landward ends to about a maximum 435-foot width, 800 feet seaward of the dock area. At the dock, there is a berthing area of 214 feet by 950 feet, with 30 feet extending north of the channel centerline. The loading trestle and dock is adjacent to the berthing area in a 173-foot by 950-foot area.

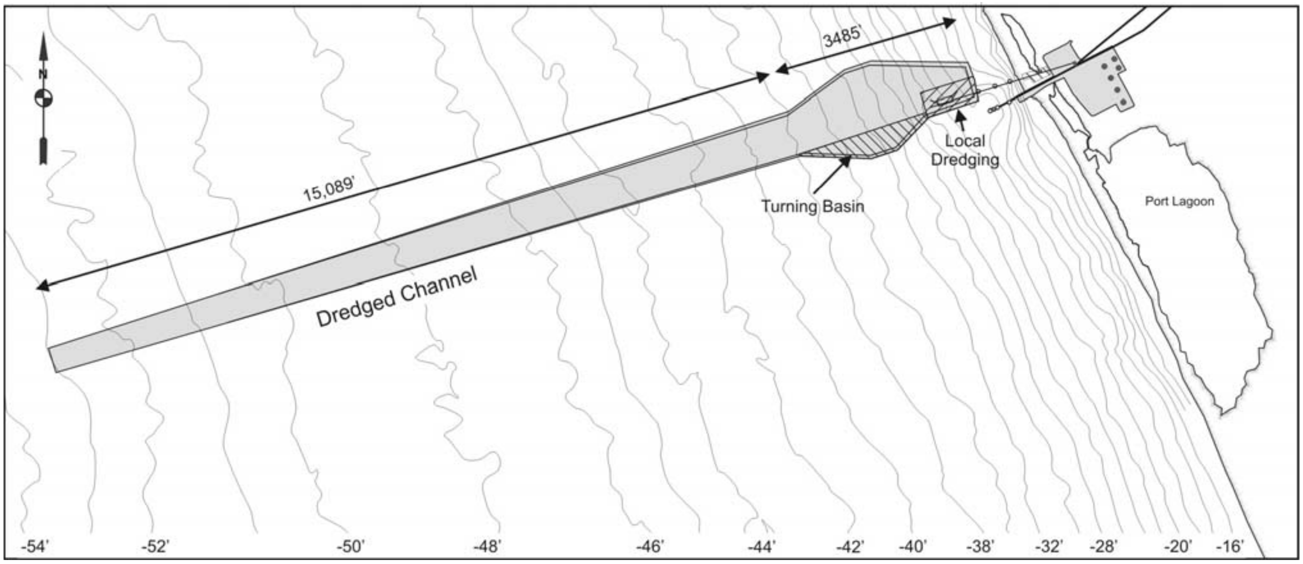

Figure 23. Selected channel

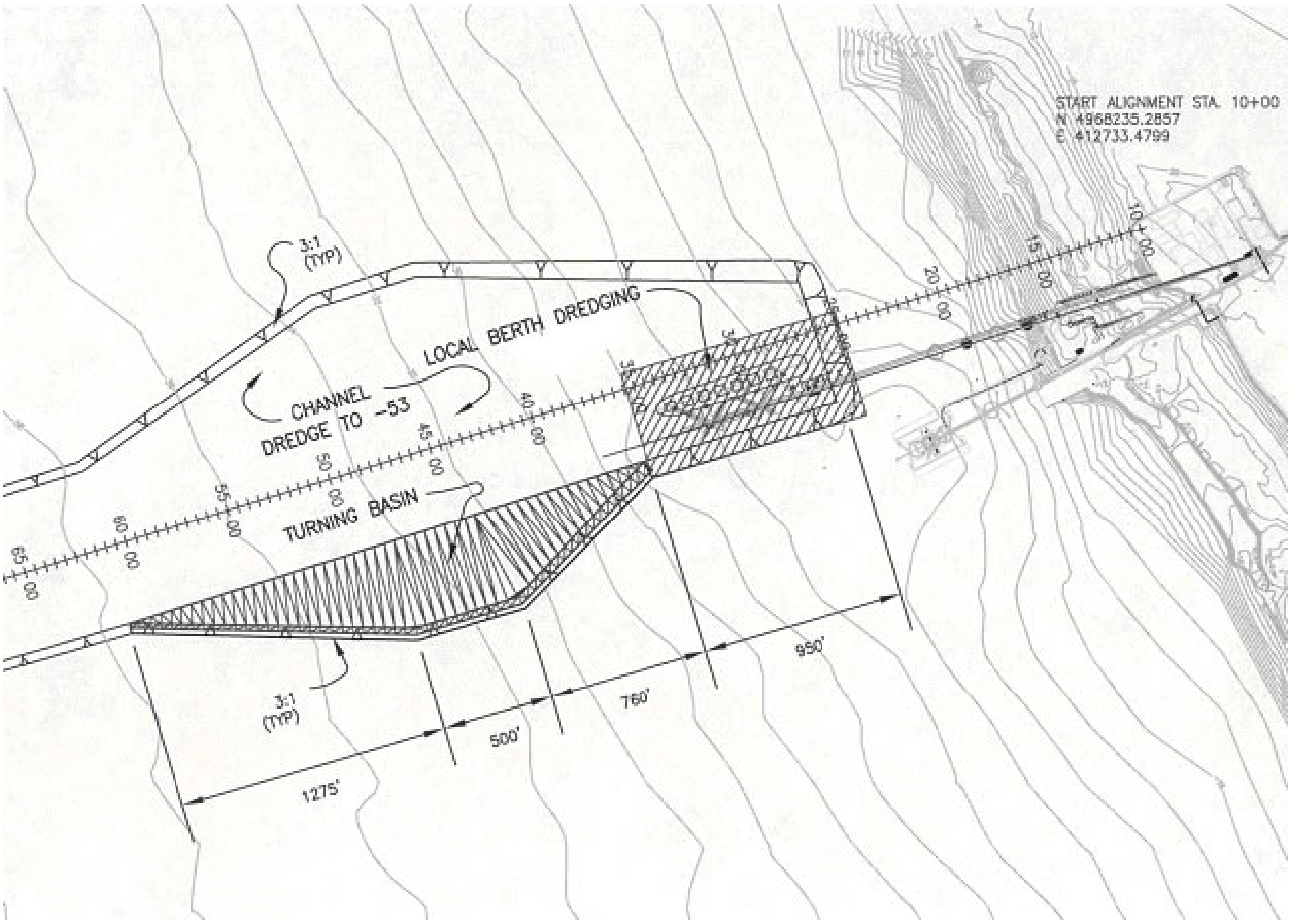

Figure 24. Channel turning basin and berthing area

3.15.4.5. Deep-Draft Trestle Alignment

During preliminary studies, a number of trestle alignments were considered and the most feasible alignment for a trestle to a new deep-draft dock appeared to be one adjacent to, but just north of, the existing barge loading trestle. As the feasibility study moved into Phase 2, the two most promising alignments were reconsidered. One option would replace the existing barge-loading, conveyor trestle (P10) with a ship-loading, conveyor trestle on the same alignment. The other option would follow an alignment (P10A) rotated clockwise about the surge bin about 11 degrees from the existing barge trestle alignment. The latter alignment was chosen for use in this feasibility level analysis due to (1) lower initial construction costs with essentially equal operation and maintenance costs; (2) lower risk of construction delays; and (3) lower risk of causing revenue losses to TCAK because of the lesser chance that not all available concentrate could be exported during the construction period. The P10A alignment could retain the existing barge loading terminal intact for use while the new project was being finished and/or provide for future use by other Portsite users. The dredged shipping channel would be parallel to the P10A alignment, with the two centerlines offset by about 280 feet.

3.15.4.6. General Cargo Considerations

General cargo is barged to Portsite by Nana/Lynden in standard 8,000 gross capacity barges (340 feet x 78 feet x 19 feet) or oversize barges of 9,000 ton gross capacity (400 feet x 84 feet x 19 feet). The minimum draft at the shallow-water dock is 15 feet, allowing both the standard and the oversize barges to arrive fully loaded. Most of the current mine operation supply cargo is containerized, consisting of process reagents, grinding balls in half-height containers, and spare parts shipped as loose stow on top of the containers. Load sizes typically range between 450 and 600 20-foot containers. The general cargo barges berth with bow ramps to shore at the shallow-water dock. Cargo is handled on a Ro-Ro system with large Caterpillar V-900 container handlers. Since there is only room for one cargo barge to dock at a time, sometimes two barges will moor side-to-side and pass cargo from one to another and then onto the dock. With no weather downtime, a single barge takes about 30 hours to unload and then load with empties. Currently TCAK imports about 35,000 tons of general cargo of which 16,000 tons could have been resourced internationally (at a potentially lower cost), if deep-sea vessels could be used for ocean transport to Portsite. For the barge alternatives, there will be minimal differences in general cargo handling with the without-project condition. If a new deep-draft berth and dock is provided at DMT, facilities can be included to provide for direct off loading from ocean going cargo or self-unloading container ships at the berth, which would provide a secondary means for cargo import. The presence of a general cargo dock would provide an opportunity for the DMT to serve as a transshipment point for northwest arctic villages.

3.15.4.7. Portsite Power Generating System Considerations

Power is generated at Portsite using diesel generators. The existing power generating station at Portsite consists of a 149-foot by 58-foot building, housing four generators with a total capacity of 3,235 kW, an electrical room, a transformer room, a desalination plant, and a glycol heating plant. Three generators are rated at 650 kW, with the fourth being a 1,285 kW unit. The electric power generation for the barge-based alternatives will be similar to the without-project condition. However, the preliminary analysis of the deep-draft alternatives indicates that additional generating capacity will be required to power the new, longer conveyors and shiploaders. The expansion as currently designed (as more detailed designs are developed, the generating arrangements may be modified) would consist of about a 3,600 –square-foot building added to the northeast side of the existing powerhouse. The building would house two, 2,208 kW generators and an electrical room. The powerhouse addition also would have an overhead bridge crane for servicing the generators and would be separated from the existing powerhouse with a firewall.

The power requirements estimated for the deep-water berth alternative include loads from the following areas: Requirements for deep-water alternative, existing loads at the Portsite, and 2002 truck unloading building dust control modifications. Prior to the navigation improvements, one of the 650 kW generators (generator G2) probably would be replaced with a new 1,322 kW generator. As a result, the 2,208 kW CAT generators would be backed up by the 1,285 kW and 1,322 kW generators.

3.16. Screening of Fuel Movement Measures

There are two strategies to consider in improving the distribution of fuel in northwestern arctic Alaska. One would be to change to a better, cleaner, more efficient source of power, heat, and energy. The other would to look for more efficient ways to acquire, transport, and distribute the current fuel, diesel oil. Potential alternative power, heat, and energy sources for the northwestern arctic are coal, natural gas, and wind. Two general development strategies to consider for improvements to the current marine transportation system for fuel movement, currently provided by DMT, include: (1) provide improvements to the existing barge-based delivery system; and (2) develop new measures for importing fuel to Portsite directly from tankers either with or without the capability for transshipment to villages by barge through the current fuel import facility. For the barge alternatives, the current fuel delivery system was reviewed and no useful improvements were identified. Thus, for barge considerations, there will be no difference between the with- and the without-project condition. The study concentrated on measures that could be employed to improve fuel movements at Portsite through deep-draft measures.

3.16.1. Alternative Sources of Energy

3.16.1.1. Coal

There are immense low-sulphur coal deposits within 100 miles north of Red Dog Mine. If this coal could be mined and burned to create energy economically, it could replace some or most of the diesel fuel now used to produce electricity at Red dog Mine and Portsite and perhaps some villages in northwestern Alaska. Currently, no coal is being mined and there are no generating facilities that can use coal in northwestern Alaska. Problems associated with mining and milling coal and using it to generate power have prevented development of coal-fired power plants. This condition is not expected to change significantly for a number of years.

3.16.1.2. Natural Gas

Small amounts of natural gas have been found in rock formations near Red Dog Mine. If natural gas could be extracted from the ground economically, it could replace diesel generation for power generation and heating. TCAK has explored for natural gas in recent years and is expected to continue to do so. They have not yet found sufficient gas reserves that are economically available to make recovery worthwhile. Natural gas may become viable as an alternative fuel in the future, but it is not feasible at this time.

3.16.1.3. Wind

Wind-driven generators can produce marketable amounts of electricity in northwestern Alaska and currently do produce a portion of the power needs in Kotzebue. Earlier problems the wind-driven systems were having with shaft speeds have been overcome. Overtime, wind-driven generators will replace a small percentage of the base load diesel generation capacity for some communities. This conversion can occur more easily for small villages than the large industrial operations at Red Dog and Portsite. Wind generation would be added to existing base load generators, but is not suitable to provide for peak power needs. It is not expected that wind generation will become a primary source of power generation for the northwestern arctic Alaska in the foreseeable future.

3.16.2. Existing Fuel Delivery Methods

Fuel for Red Dog Mine and DMT Portsite is delivered by Crowley standard-type fuel barges with a fully loaded capacity of 5,250,0000 U.S. gallons. Each year, the standard practice has been to initially bring a fully loaded barge from Puget Sound and offload about 1,000,000 gallons at Kotzebue to reduce the barge draft to 17 feet before proceeding to Portsite to offload the remainder. The barges hold approximately 4,000,000 U.S. gallons at 17 feet draft. Fuel barges currently unload at the south barge berth and pump-off their cargo to the Portsite tank farm via a 12-inch pipeline. Typical unloading time is 14 to 18 hours, with peak pump-off rates of 350,000 U.S. gallons/hour or 5,800 U.S. gallons per minute (gpm) and average rates of 4,000 U.S. gpm. To minimize the risk of collision and spillage, current practice is to stop concentrate lightering on the south berth and delay berthing of general cargo barges when fuel barges are discharging. The north concentrate berth continues in operation during fuel transfer activities. The barge will usually pull off the berth if significant waves exceed 3 to 4 feet and the forecast is for worsening weather. Once emptied, the barge then returns to Kenai to reload for the next trip north. The present service involves four or five barge trips to Portsite each summer operating on a 25 to 30-day arrival cycle. The DMT tank farm has six similar fuel-oil storage tanks that provide a total storage capacity of 15,000,000 U.S. gallons. The vast majority of the fuel is trucked to the mine for power generation and consumption by mobile equipment. The mine has three fuel storage tanks with a total capacity of 2,400,000 U.S. gallons. DMT fuel consumption consists of DMT generators, reclaim equipment, general cargo handling equipment, and other small equipment. DMT annual consumption is currently 900,000 U.S. gallons. Winter fuel storage requirements, mainly determined by mine, mill, and trucking operations, total 17,400,000 U.S. gallons. All available fuel storage tanks must be completely filled at the end of each shipping season.

3.16.3. Development, Evaluation, and Comparison of Fuel Measures

The design of improvements to DMT's fuel facilities needs to consider the potential increases in fuel throughput in the future. The combined future annual inbound throughput for both TCAK operations and potential storage for village transshipment is 52,700,000 U.S. gallons. Potential future outbound throughput for barge shipment to villages could range up to about 30,000,000 U.S. gallons. As part of the feasibility study, initial fuel handling measures were evaluated and screened to remove those that clearly will not work, will not meet the planning objectives, or are clearly inferior to other similar options in regard to completeness, effectiveness, efficiency, or acceptability. Table 21 lists the 21 identified measures for modified fuel delivery. The table provides a qualitative assessment of the potential of each of the measures in regard to the primary evaluation criteria identified earlier in this section. Only those eight measures in **boldface** in table 21 are being retained for further consideration in this study.

3.17. Considerations for Combining Fuel Measures into Alternatives

In combining the fuel delivery measures into alternatives, like the concentrate measures, a number of measure comparisons can be made to reduce the number of combinations to consider. These include identification of stand-alone measures and opportunities for combinations with previously discussed concentrate alternatives.

3.17.1. Stand Alone Alternatives

Of the fuel delivery measures considered in the initial screening, only the Deep-Draft Fuel Facility could stand-alone. Measures G2, G3b, G4a(i), G4b and G4c(i) will be combined and designated Alternative 7 and referred to as the "Tanker Facility Alternative."

3.17.2. Combinations with Other Alternatives

The tanker fuel transfer facilities can easily be added to the lightering barge based alternatives and to the concentrate Trestle-Channel and Tunnel-Channel alternatives. Alternatives 2 and 7 will be added together to form Alternative 8 and designated the "Third

Barge and Tanker Alternative." Alternatives 3 and 7 will be added together to form Alternative 9 and designated the "Breakwater and Tanker Alternative." Alternatives 4 and 7 will be added together to form Alternative 10 and designated the "Third Barge, Breakwater, and Tanker Alternative." Measures G2 and G5a will be added to previously discussed Alternative 5 to form Alternative 11 and designated the "Trestle-Channel-Tanker Alternative." Measures G2 and G5b will be added to the previously discussed Alternative 6 to form Alternative 12 and designated the "Tunnel-Channel-Tanker Alternative."

Table 21. Fuel Transfer Measures

Measure	Description	Completeness	Effectiveness	Efficiency	Acceptability
G1	Barge-Based Improvements	Not needed	Not needed	N/A	NO
G2	**Onshore Fuel Pumping Facilities**	**YES**	**YES**	**MAYBE**	**YES**
G3	Spill Response Equipment	-	-	-	-
G3a	Additional Equipment Required for Barge Measures	Not needed	NO	NO	NO
G3b	**Additional Equipment Required for Fuel Facility**	**YES**	**YES**	**MAYBE**	**YES**
G3c	Additional Equipment Required for Trestle/Tunnel	Not needed	NO	NO	NO
G4	Deep-Draft Fuel Facility	-	-	-	-
G4a	Nearshore Pipeline	-	-	-	-
G4a(i)	**Horizontal Directionally Drilled Tunnel**	**YES**	**YES**	**MAYBE**	**YES**
G4a(ii)	Excavated/Dredged Trench	YES	YES	MAYBE	NO
G4b	**Offshore Pipeline - Excavated/Dredged Trench**	**YES**	**YES**	**MAYBE**	**YES**
G4c	Offshore Fuel Facility	-	-	-	-
G4c(i)	**Multi-Buoy Mooring (MBM)**	**YES**	**YES**	**MAYBE**	**YES**
G4c(ii)	Monopile	YES	YES	NO	YES
G4c(iii)	Single Anchor Leg Mooring (SALM)	YES	YES	NO	YES
G4c(iv)	Gravity Based Structure (GBS)	YES	YES	NO	YES
G4c(v)	Offshore Island	YES	YES	NO	NO
G 5	Fuel Facilities Added to Screened Concentrate Measures	-	-	-	-
G5a	**Fuel Facility on Trestle**	**YES**	**YES**	**MAYBE**	**YES**
G5b	**Fuel Facility in Tunnel**	**YES**	**YES**	**MAYBE**	**YES**
G5c	**Modify Existing Barge Fuel Facility for Export**	**YES**	**YES**	**MAYBE**	**YES**

3.18. Development of Mitigation Measures

As part of the feasibility study process, potential alternatives and their impacts are reviewed to determine possible mitigation measures. Concerns raised during scoping, coordination with agencies and stakeholders, and analysis of potential impacts of alternative construction, operation, and maintenance, identified those measures as ones that might avoid or reduce adverse impacts. Mitigation concentrates on repairing/replacing unavoidable damages to fish and wildlife resources. Under the Principles and Guidelines, further refined by the Chief of Engineers' Environmental Operating Principles, consideration of environmental measures is part and parcel of the planning process and not just "add-on" to a pre-selected plan. Mitigation seeks to maintain significant environmental resources at the without-project condition. Mitigation measures identified as part of this study are listed in table 22 and are described in following paragraphs. After screening and evaluation of concentrate and fuel measures in the next section, mitigation measures appropriate for each alternative will be identified in Section 3.19.

Table 22. Potential Mitigation Measures

Measure	Description	Comment
M1	Establish marine work timing windows	Reduces impacts on subsistence hunting
M2	Monitor marine mammals during/after construction	Difficult to differentiate natural/project impacts
M3	Seasonal mammal observation post on dock	Assist hunters to spot mammals for hunting
M4	Minimize free-strung wires	Reduce strikes by migratory waterfowl
M5	Restrict exposed artificial lighting on structures	Reduce disorienting/blinding birds
M6	Paint structures bird-friendly colors	Makes structures more visable to birds
M7	Open-ocean ballast water exchange	Prevent introduction of invasive species
M8	Conduct cultural resources surveys & monitoring	Protects historic resources present
M9	Require cultural resource & social awareness training	Minimizes conflicts during construction
M10	Dispose dredged material upcurrent	Minimize dispersal of material outside site
M11	Monitor dredged material disposal plume	Use for site adaptive management
M12	Remove shallow water dock or by-pass material	Maintain natural beach processes
M13	Perform annual By-pass dredging	Maintain natural sediment movement
M14	AIDEA work with Noatak on Red Dog-Noatk road	Facilitates personal, fuel, cargo movement
M15	Involve regional fuel distributors in design planning	Promotes passing savings thru to residents
M16	Hire construction workers locally	Promotes local residents & economy
M178	Use a directionally drilled tunnel for first 2,500 feet	Reduces impact in shore zone with beach
M18	Monitor Hard Bottom Habitat	Project introduces habitat rare in local area
M19	Catchment and reporting system for eider strikes	Documents actual birdstrikes
M20	Develop radar monitoring system for birds	Provides data on bird behavior

3.18.1. M1 – Construction Timing Windows

This measure would establish timing windows to avoid work each year in or near the Chukchi Sea from March 15 until notification from the NANA subsistence committee (about June 30). The majority of marine mammals harvested for food are taken during this period. Avoiding or minimizing activity on the Chukchi Sea during this period would prevent noise and activity from affecting hunts for bowhead whales, the Beaufort Sea stock of beluga whales, seals, and polar bear, all of which are hunted almost exclusively during that period. Restrictions would affect construction schedules and could add to construction costs. This measure is included in all alternatives, except No Action.

3.18.2. M2 – Marine Mammal Monitoring

This measure would monitor marine mammals during and after construction to look for problems and potential for modifications to the project features or operations. Available data do not predict substantial project effects to fish and wildlife. This could be checked, and corrective measures could be implemented, if experts knowledgeable of subsistence resources were employed to monitor project effects during critical periods. Monitoring would be directed principally toward determining abundance of marine mammals offshore from Portsite and the distance offshore of bearded seal. Monitoring could be established with the assistance of regional subsistence experts. Cost to the project would be about $100,000 per year for 5 years. This measure is included in all alternatives, except No Action.

3.18.3. M3 – Seasonal Mammal Observation Post

This measure would install a seasonal observation post on any new dock to assist marine mammal hunters. The deck would be a stable platform 40 feet above the Chukchi Sea that would provide visibility for miles offshore. A modified, insulated steel shipping container or other structure could be fitted with a window, electrical wiring, and perhaps other features to create a place where subsistence hunters could maintain a watch for marine mammals from the platform. This concept appears to be workable, but interest by local hunters is uncertain. The decision on including this measure in alternatives is deferred until after public review and comment of the draft EIS and draft IFR.

3.18.4. M4 – Minimize Free Aerial Wires

This measure would minimize free-strung wires and other structural components likely to result in bird strikes. Wires and other structural components that are hard for birds to see could increase the chances for strikes by migratory waterfowl. This design criterion is included in alternatives 5, 6, 11, and 12.

3.18.5. M5 – Restrict Lighting

This measure would restrict lighting in conditions that would increase probability of bird strikes. Intense lighting can disorient or temporarily blind birds, increasing potential for bird strikes. Hooding work lights or restricting light use at night has been shown to reduce bird strikes at some locations during migratory periods. Hooded lights would be used as a design detail to avoid attracting or disorienting birds. This measures applies to alternatives 5, 6, 11, and 12.

3.18.6. M6 – Use Bird Friendly Paint

This measure would paint the trestle, platform, and loaders a color visible to birds. Bird eyes have light reception cones for reds, blues, and greens, and are able to see colors. A brightly painted trestle might be more visible to birds than a gray trestle and reduce the potential for bird strikes in fog. Marine mammals are colorblind and would not be able to distinguish those colors. Bright colors on a trestle at Portsite would not affect marine mammals but would be selected to contrast with the spring and autumn landscape. The colors might be visually intrusive to people at Portsite and Kivalina and to people passing through the area. This measures applies to alternatives 5, 6, 11, and 12.

3.18.7. M7 – Ballast Water Exchange or Ionization

This measure would require open-ocean ballast water exchange or ionization to prevent introduction of invasive marine species. Ballast water in the bulk carriers could introduce marine organisms from other parts of the world. This has caused invasive species problems in warmer marine waters of the world, including the Pacific Northwest of the United States. Marine organisms tend to ride Pacific Ocean currents northward from the west coasts of the United States and Canada. Nuisance organisms that have reached those coasts are likely to drift progressively northward until they reach the Chukchi Sea, if they can survive the long winters, cold temperatures, ice gouging, and other severe conditions. Distance and these natural barriers apparently have prevented invasion by exotic species of marine organisms. There also is no reported indication that ballast water from Portsite loading operations, which began more than 15 years ago, has introduced invasive species. Open ocean exchange of ballast water or ionization does not appear to be required to avoid invasive species introduction and is not included in any alternative.

3.18.8. M8 – Cultural Resource Survey

This measure would protect archeological resources by conducting site-specific cultural resources surveys prior to construction or monitoring during construction. Cultural resources surveys after design is completed or monitoring during construction would ensure that historical resources were avoided or protected. Cost to project is about $30,000. This work is the minimum required to meet cultural resource protection requirements. This measure is included with all alternatives, except for alternatives 1, 2, 3, and 4.

3.18.9. M9 – Awareness Training

This measure would provide cultural resource and social awareness training for all construction workers. Construction personnel unfamiliar with the importance of cultural properties, including historical sites near Portsite, or the potential for their activities to affect subsistence harvesting could unintentionally cause adverse effects. Proper training could minimize this potential. The cost to project is about $20,000. This measure is included in all alternatives, except alternatives 1 and 2.

3.18.10. M10 – Up-Current Disposal

This measure would dispose of dredged material in the up-current part of the disposal area. Most dredged material would quickly sink to the bottom, although currents could carry at least small amounts away from the disposal area. Currents offshore from Portsite rarely exceed 1 mile per hour during the summer and after dredging season. Restricting disposal to the up-current part of the disposal area during relatively strong currents would minimize dispersal of sediment outside the designated disposal area. This alternative might add a half-hour or more to each round trip with dredged material, or several hundred hours (several weeks) of total transportation time to the project. The need for this measure and incremental costs to the project will be estimated after ODMD Section 102 site designation. This measure is not recommended for any alternative, pending ODMD site designation.

3.18.11. M11 – Dredged Plume Monitoring

This measure would monitor the dredged material plume both at and down current from the disposal release location. Data collected during initial dredged material disposal operations could be used to modify disposal operations if required. Cost to project is about $50,000. This is the minimum cost for one data set during a reasonable range of marine conditions. This measure is included in all alternatives, except alternatives 1, 2, 3, and 4.

3.18.12. M12 – Remove Shallow Water Dock

This measure would restore littoral transport by removing the existing shallow-water, solid-fill dock and/or replace it with a pier structure. The existing solid-fill dock at Portsite interrupts natural beach processes and appears to have caused beach erosion to the south. The dock is needed for Portsite operations but could be replaced by an expensive pier structure. Effects could be mitigated less expensively by moving accreted material from the north to the south side of the dock during annual bypass dredging. This measure is not included in any alternative, giving preference to measure M13.

3.18.13. M13 – Annual By-Pass Dredging

This measure would conduct annual by-pass dredging to maintain beach processes south of Portsite. Wave reduction caused by the marine structures would allow sediment to build up shoreward of the turning basin. Annual bypass dredging would maintain natural sediment transport processes and would prevent beach erosion to the south. Cost to project is estimated at $325,000 annually. This measure is included in all alternatives, except alternatives 1, 2, 7, and 8.

3.18.14. M14 – Noatak Road Planning

This measure would involve working with Noatak to evaluate the feasibility of a road between the DMT road and Noatak. Cost of shipping to Noatak threatens the economic viability of the community. Lack of an alternate airport sometimes delays crew changes and resupply for Portsite and the Red Dog Mine. A road connecting Noatak and the DMT road could reduce both problems. This is outside the scope of this study, but the non-federal sponsor could agree to work with Noatak and other stakeholders to study the feasibility of a road. The sponsor could also agree to help develop funding and participation by other state and federal agencies if a road appeared to be feasible. There would be no cost to the navigation improvement project. This measure is considered on all alternatives.

3.18.15. M15 – Regional Fuel Planning During Design

This measure would involve regional distributors in fuel distribution planning during project design to support local and regional employment and economic objectives. Regional fuel distribution out of Portsite could affect distributors that now do business in northwestern Alaska. Involving them in specific plans to meet fuel distribution objectives would allow those distributors to maintain or grow their position in this business. There would be no direct cost to the project. This measure is included in all alternatives that address fuel distribution (7, 8, 9, 10, 11, 12).

3.18.16. M16 – Local Hire

This measure would encourage construction contractors to hire locally as job positions allow. Federal regulations limit the local hire provisions in contracts for construction of federal projects. The strongest incentives consistent with federal regulations could be inserted in contract requirements for construction activities. There would be no direct cost to the project. This measure is included with all alternatives, except alternatives 1 and 2.

3.18.17. M17 – Drilled Tunnel for Pipeline

This measure would use a drilled tunnel for the initial 2,500-foot length of fuel pipeline extending from shore instead of a cut-and-cover design. The cut-and-cover plan would significantly disturb the near-shore beach processes. The drilled tunnel segment would cost about $1.5 million more than a cut-and-cover design, but would have minimal impact on the beach and near-shore habitat. This measure is included in those alternatives having an underground-underwater fuel pipeline: alternatives 7, 8, 9, and 10.

3.18.18. M18 – Monitor Hard Bottom Habitat

This measure would include monitoring studies for those alternatives where the current ocean bottom habitat would be changed by the imposition of hardened structures, such as a breakwater or the concrete mat over the fuel pipeline. These alternatives would cause a significant change in the habitat under their footprint, since there is no significant hard-bottom habitat in this part of the Chuckchi Sea. Studies would be required to monitor and document how the change in bottom type proceeds to change the marine habitat and the animals and plants that should colonize. The cost to the project is estimated at $500,000 per year for 5 years, which is the minimum period that should yield noticeable results. This measure is included in alternatives 3, 4, 7, 8, 9, and 10.

3.18.19. M19 – Catch and Report Bird Strikes

This measure would include the installation of a catchment system along both sides of all infrastructure extending over water. The system would be monitored for bird strikes daily with reporting of bird strikes to the USFWS. The species, date, weather conditions, and location along the infrastructure would be recorded. This measure could be included in alternatives 5, 6, 11, and 12.

3.18.20. M20 – Radar System to Monitor Bird Behavior

This measure would provide for radar monitoring of bird behavior during the spring and fall migration periods before and after project construction. Information on bird behavior/strikes would be used as input to determine the effectiveness of other mitigation measures and possibly guide project modifications, if bird strikes are actually a problem. This measure could be included in alternatives 5, 6, 11, and 12.

3.19. Ecosystem Restoration Opportunities

In accordance with proper planning procedures and the Chief of Engineers' Environmental Operating Principles, the study team reviews environmental conditions in the study area to determine whether opportunities exist for ecosystem restoration measures. These measures improve the quality of the environment in the public interest. They look to return a degraded wildlife habitat to a less degraded condition to improve the without-project condition. Ecosystem restoration measures should restore ecosystem structure, functions, and values, resulting in improved environmental quality. The area around Portsite was reviewed to determine whether degraded habitat of national significance was present. Within 100 miles of Portsite along the shores of the Chukchi Sea, there is extremely limited development on the shore and adjacent arctic tundra. Only three small communities exist along the coast in the immediate project area: Kivalina (15 miles away with 377 residents); Kotzebue (65 miles with 3,082); and Point Hope (75 miles away with 757). In addition, 40 miles inland is Noatak with 428 residents. The only industrial development along this portion of the Chukchi Sea is DMT, the DMTS, and Red Dog Mine. No nationally significant resources were identified that had reached such a degraded condition that consideration of ecosystem restoration measures would be appropriate as part of the current study effort.

3.20. Phase 2 Comparison, Evaluation, and Screening of Alternatives

Based on preliminary studies, the measures that appeared to warrant more detailed consideration in Phase 2 of this feasibility study analysis were combined to create the screened alternatives listed in table 23. This screening was based primarily on a qualitative analysis using the primary evaluation criteria (completeness, effectiveness, efficiency, and acceptability), cost, and implementability factors. These screened alternatives to be considered in Phase 2 of this feasibility study are described in the following paragraphs. The without-project condition becomes Alternative 1, the No Action Plan. Alternatives 2, 3, and 4 improve the existing concentrate lightering barge system. Alternatives 5 and 6 involve a direct load/unload facility serving deep-draft vessels carrying base metal concentrate.

Alternative 7 provides a deep-draft tanker offshore fuel facility. Alternatives 8, 9, 10, 11, and 12 provide for improvements for both concentrate and fuel movements.

Table 23. Alternatives For Phase 2 Screening

Alternative 1	No Action
Alternative 2	Third Barge
Alternative 3	Breakwater
Alternative 4	Third Barge and Breakwater
Alternative 5	Trestle-Channel
Alternative 6	Tunnel-Channel
Alternative 7	Offshore Tanker Facility
Alternative 8	Third Barge and Offshore Tanker Facility
Alternative 9	Breakwater and Offshore Tanker Facility
Alternative 10	Third Barge, Breakwater, and Offshore Tanker Facility
Alternative 11	Trestle-Channel-Tanker Facility
Alternative 12	Tunnel-Channel-Tanker Facility

In Phase 2 formulation, the degree to which each alternative could meet the planning objectives to more efficiently move both concentrate and fuel was a significant factor. Plans that only satisfied single objectives would be dropped in preference to those that could meet more than one planning objective. As described in Appendix E, Economic Analysis, and Appendix F, Portsite Dynamic Simulation Model, the computer, vessel simulation model was developed to reflect conditions currently existing for ship and barge queuing and delays at DMT and to evaluate the changes that various alternatives would have. The NED benefits were then estimated based on a number of factors, including reduced transportation costs, reduced delays, reduced fuel prices, etc. A preliminary evaluation was also made of the potential impacts each alternative might have. Each alternative was then evaluated against the four primary evaluation criteria. Alternatives were either dropped from further consideration or continued into Phase 3 formulation based on that comparison. The following paragraphs discuss the development, optimization, comparison, evaluation and screening of Phase 2 formulation alternatives.

3.20.1. No Action – Alternative 1

The No-Action Alternative is defined as a continuation of existing conditions or the addition of a relatively small change that is currently underway and due to be in-place within a year or two, independent of the possible federal project. For this study the No-Action Alternative is the without-project condition discussed in Section 3.6. This alternative would continue the current lightering system with the recently completed relatively minor improvements implemented by TCAK under its Value Improvement Program. The four tug and two lightering barge operation would continue.

Since the ore concentrate loading process and fuel consumption, delivery, storage and distribution operations would remain unchanged, there would be no short or long-term adverse or beneficial effects to environmental resources. This alternative could include mitigation measure M14, which encourages the State of Alaska to work with local communities on planning a road from Noatak to the DMT road.

Alternative 1, No-Action, the without-project condition, is automatically carried in Phase 3 formulation.

3.20.2. Third Barge – Alternative 2

For this alternative, a third lightering barge with one more assist tug would be added to the existing operation during the summer, open-water season each year to increase the reliability of achieving the annual throughput goals (figure 26). A delay problem currently experienced at the barge loading facility is due to adverse winds and waves. However, the single barge loader is not used 100 percent of the time. Since there are periods when both barges are either in transit or at the bulk ship, the loader is often left idle during calm weather conditions. During these periods, the single loader could be in use, except there is no barge available. For ease of operation and maintenance, the new barge would be designed substantially the same as the existing two, self-unloading, lightering barges, the *Kivalina* and the *Noatak*. This is considered to be a substantially "non-structural" alternative because no major modification of the existing port facilities would be required.

Figure 25. Third barge with tug

The first cost of a 3,000-horsepower tug and a self-unloading 5,500-ton barge is estimated at $19.2 million, with a full replacement at year 25. Based on the vessel simulation model, there is expected to be about 34 weather days at Portsite annually that would interrupt lightering barge operations resulting in a combined total delay queue time for the bulk carriers of 200 ship-days. The sponsor's consultant estimates that, based on the hindcast and other hydraulic analyses, Portsite would be able to meet its commodity projections about 94 percent of the time in the future.

Adding a third barge and tugs to accompany it would not alter loading operations or associated fugitive dust emissions. Fuel consumption and associated exhaust emissions would increase by a small percentage due to the annual mobilization, operation and demobilization of the third barge and the tugs needed to support it; additional barge conflicts at the loader, dock, and navigation lanes; and an incremental increase in hoteling near Portsite. Fuel delivery, storage, and distribution operations would remain unchanged. The additional barge and tugs would be new sources of sound, but would not make any appreciable difference in the strength of sounds in the water around Portsite or the distances those sounds could be heard. There would be no significant short or long-term adverse or beneficial effects to environmental resources. This alternative would include only mitigation measure M14 from table 22.

The economic analysis for this alternative indicated that the NED benefits (reduction in ship queue delay of $1,208,100 and induced concentrate tonnage of $1,707,900) are exceeded by the NED costs (amortized tug and barge costs of $3,736,831, vessel transit costs of $232,900, and increased associated costs to cover the extra crew of $129,600). This results in a net loss compared to the without condition of $1,183,331.

This alternative would only deal with moving concentrate and does nothing to improve fuel or general cargo movement. Therefore, while only complete for concentrate, it is not at all effective, does nothing for fuel, and is far from efficient. However, this alternative will be carried into Phase 3 for comparison purposes because it does serve as a nonstructural alternative.

3.20.3. Breakwater – Alternative 3

A breakwater would be constructed offshore, providing protection for the barge loading berths from adverse wind and wave conditions, which cause concentrate loading at the barge dock to be interrupted. During 2000, the average weather delay for 19 events was 41 hours each. A breakwater would be expected to eliminate about 3/4 of weather delays currently experienced. The breakwater would be 2,800 feet long, placed 695 feet west of the barge loading facility and extend to +10 feet above Mean Lower Low Water (MLLW) (figure 26). A solid rock structure of this type would be expected to cause some environmental impact due to the loss of seabed habitat and presence effects, but the loss would not be significant due to the abundance of like habitat in the area. With the breakwater in place, the shipping simulation studies have shown that the desired concentrate throughput could reliably be achieved with the current marine contingent of two self-unloading barges and four tugs.

In order to reduce the shutdowns of barge loading due to adverse weather conditions, the wave climate must be kept to conditions with 3-foot waves or less. The breakwater length is based on reducing a 6-foot wave approaching the shoreline at 30 degrees to 3 feet or less at the barge loader. The breakwater would rise from a sea bottom of about -24 feet MLLW to a top elevation of +10 feet MLLW and would be composed of armor stone overlying quarry rock and bedding stone layers, have a top width of 18 feet, and side slopes generally 1 vertical to 2 horizontal. The bottom width of the rock on the existing sea bottom would be about 206 feet, covering about 14 acres.

Interruption of ship loading would still occur when waves grew to 6.6 feet or greater. The 15-year hindcast indicated that waves of that magnitude would occur for only 3.8 days each shipping season. This small number of weather shut-down days would not significantly impact the movement of concentrate by lightering barges. Left unchecked, sand and other sediment would deposit behind the breakwater after construction, creating a tombolo that would reduce the depth between the breakwaters and the existing loading facility. To prevent this, annual maintenance would be preformed to bypass accumulated sediment, estimated at 26,000 yd^3 annually, to the south.

The ore concentrate loading process would remain unchanged, but the loss of ore concentrate at the loading dock may be slightly reduced by improved loading conditions. Construction of a breakwater would bury existing biological resources at the site it was constructed and cause minor and localized adverse impacts to other marine resources and air quality but would create new, rock-based habitat that does not currently exist near Portsite. After construction, maintenance and operation of the facilities would continue to cause smaller scale impacts. Fuel delivery, storage, and distribution operations would remain essentially the same, but improved conditions at the dock may reduce the likelihood of fuel spills and accidents. Limited impacts to cultural, visual, and subsistence resources or activities would also be anticipated. This alternative would include mitigation measures M1, M2, M9, M13, M14, and M18 from table 22.

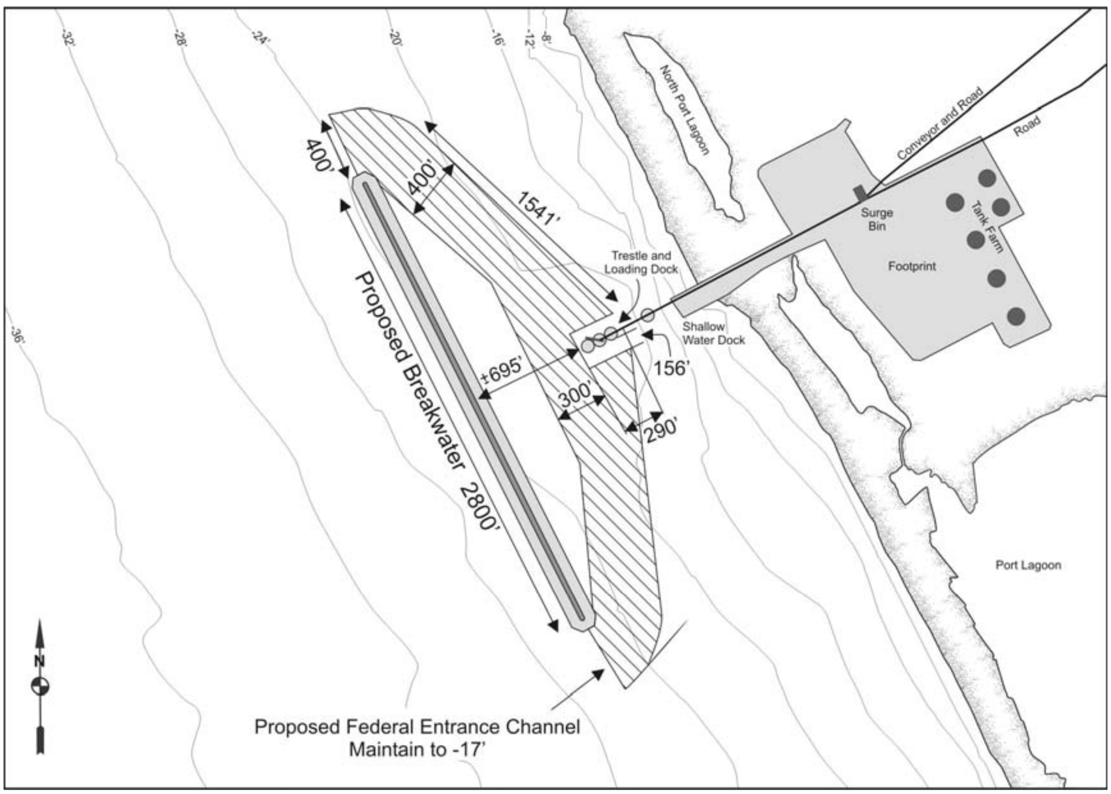

Figure 26. Rock breakwater

The first cost of a breakwater is estimated at $69,639,452 (October 2004 price level) with an annual OMRR&R cost of $425,153. When amortized over the 50-year economic analysis period at the 5-3/8 percent interest rate, the average annual costs are $4,781,623. Based on the vessel simulation model, there is expected to be about 4 weather days at Portsite annually that would interrupt lightering barge operations, resulting in a combined total delay queue time for the bulk carriers of 200 ship-days. The sponsor’s consultant estimates that, based on the hindcast and other hydraulic analyses, Portsite would be able to meet its commodity projections about 98 percent of the time in the future. The ship simulation model results indicate that delays would be reduced and transportation costs lowered by $4,562,400, resulting in average annual negative net NED benefits of $219,223 and a benefit-to-cost ratio of 0.95 to 1.0. Because the breakwater would also shield the shallow-water barge dock, there may be some incidental benefits associated with existing fuel and general cargo operations, which have not been estimated.

This alternative would only move concentrate more efficiently and does nothing significant to improve fuel transport or general cargo movement. Although it yields annual benefits of $4.5 million on a $69 million investment, this alternative was screened out in Phase 2 formulation in favor of Alternative 9, which produces benefits for both concentrate and fuel movements.

3.20.4. Third Barge and Breakwater – Alternative 4

This alternative would combine Alternative 2, the Third Barge and Tugs, and Alternative 3, Breakwater. We have already seen that Alternative 2 has negative net benefits. Therefore, unless there is an overriding synergistic effect, which is not the case here, the combination will not be as good as Alternative 3 by itself. Based on the vessel simulation model, there is expected to be about 34 weather days at Portsite annually that would interrupt lightering barge operations, resulting in a combined total delay queue time for the bulk carriers of 200 ship-days. The sponsor’s consultant estimates that, based on the hindcast and other hydraulic analyses, Portsite would be able to meet its commodity projections about 94 percent of the time in the future.

Adding a third barge, tugs to accompany it, and a breakwater would not significantly alter ore concentrate loading operations, but the loss of ore concentrate at the loading dock may be slightly reduced by improved loading conditions. This alternative would create new, rock-based habitat that does not currently exist near Portsite. Fuel consumption and associated exhaust emissions would increase by a small percentage due to the annual mobilization, operation, and demobilization of the third barge and the tugs needed to support it; additional barge conflicts at the loader, dock, and navigation lanes; and an incremental increase in hoteling near Portsite. Fuel delivery, storage, and distribution operations would remain essentially the same but improved conditions may reduce the likelihood of fuel spills and accidents. The additional barge and tugs would be new sources of sound, but would not make any appreciable difference in the strength of sounds in the water around Portsite or the distances those sounds could be heard. Limited adverse impacts to cultural, visual, and subsistence resources or activities would also be anticipated. This alternative would include mitigation measures M1, M2, M9, M13, M14, M16, and M18 from table 22.

The economic analysis for this alternative indicated that the NED benefits (reduction in ship queue delay of $3,179,400 and induced concentrate tonnage of $1,707,900) exceed the NED costs (amortized tug and barge costs of $3,736,831, amortized breakwater costs of $4,781,623, and increased associated costs to cover extra crew of $129,600). This results in a negative net NED benefit of $3,760,754 and a benefit-to-cost ratio of 0.56 to 1.0. Therefore, this alternative was screened out in Phase 2 formulation as not complete, efficient, or acceptable.

3.20.5. Trestle-Channel – Alternative 5

A new trestle would extend to a dock in deeper water than the existing dock (figure 27). It would be constructed so that it would not interfere with operation of the existing barge lightering facilities during construction. The steel, through-truss trestle would be about 35 feet above the water and carry an enclosed concentrate conveyor system(s), a roadway, and utilities from the shore to the dock. The dock would support a moveable crane(s) and two, 2,600 tons per hour (tph) fixed radial, mineral concentrate shiploaders. No provisions would be included to service ocean-going tankers. Dock construction would employ a specialized barge, probably built in a U.S. shipyard due to Jones Act requirements. The barge/dock would be towed from a shipyard by tug with construction equipment and materials on-board and jacked-up into a temporary configuration. The dock-supporting marine foundations would be built off the barge deck and then the barge would be permanently attached to them. Ten marine foundations would be required to support the trestle and the dock. The two most landward of these would be 74-foot-diameter steel cellular sheetpile cells. The remaining eight foundations would be of conical pile design (a cluster of seven steel piles with an ice-breaking cone at the water level). From the dock seaward, a deep-draft channel would be dredged to deep-water in the Chukchi Sea (figure 23). The dredging would be accomplished with hopper and/or clamshell dredges, with disposal offshore in an area about 2 miles seaward of the seaward end of the channel. A number of deep-draft dock and trestle variations of this alternative would be developed and the optimum combination for the length of the trestle and the depth/length of dredged channel would be determined during Phase 3 formulation.

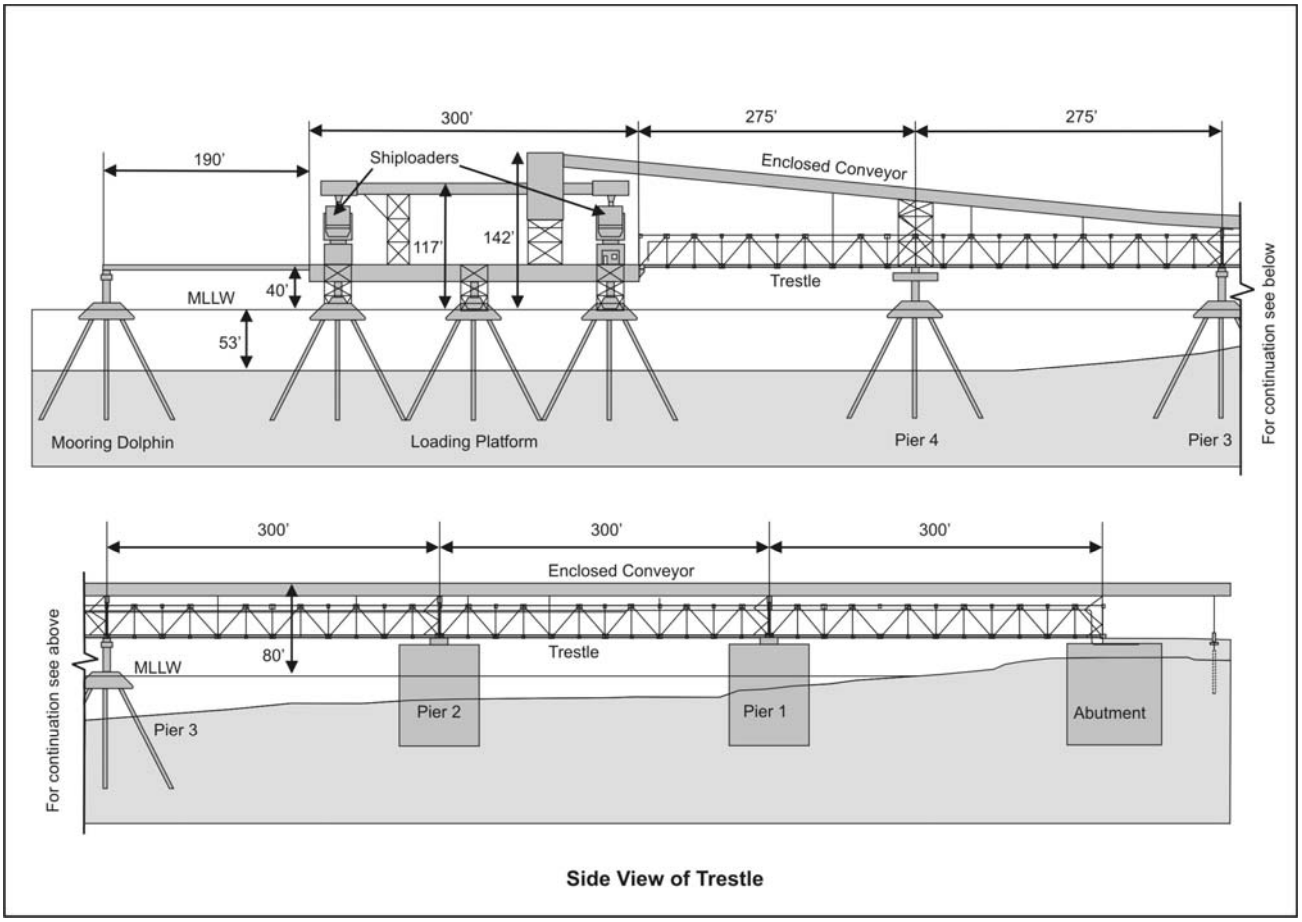

Figure 27. Deep draft dock and trestle

This alternative would provide a steel truss trestle carrying a concentrate conveyor and vehicle access to a deep-water dock and a dredged channel, extending from the dock to deep water. No provisions for tanker fuel delivery would be included. In order to develop the quantities and cost estimates, a number of parameters needed to be determined. These included design vessel and channel depth, channel location, alignment and configuration, channel dredging, dredged material disposal site, trestle and dock design.

3.20.5.1. Design Vessel and Channel Depth

The design vessels were determined by examining the size of ships currently calling at DMT to determine the most likely vessels to serve DMT in the future. Details of the design ships selected were previously discussed in Section 3.9.4.2. Channel design depth is based on ship factors, including static draft, squat, wave safety, and dredging uncertainties (figure 28). The maximum draft of ships serving DMT has been assumed to not exceed 45 feet. Squat is a hydrodynamic effect that reflects draft increases caused by hydrodynamic pressure gradients created by motion through water. A squat allowance of 1.5 feet was estimated for the design ship. The wave hindcast indicated that the wave climate is generally composed of young, short-period waves that cause little response in deep draft vessels. A value of 3 feet of heave (up and down motion) in response to waves was assumed. Based on the bottom material being described as medium to dense material consisting of silt, sand, and gravel, the safety clearance was set at 3 feet. Because dredging equipment does not provide a smoothly excavated bottom at a precisely defined elevation, an additional 1-foot allowance, called the “allowable overdepth dredging,” is included to guarantee mariners a least-depth equivalent to the sum of the ship factors. Total clearance allowance is 8 feet. Thus, for a vessel drawing 45 feet, a design channel 53 feet deep would be developed. Actual dredging, including the 1-foot allowable overdepth dredging, could extend down to – 54 feet MLLW. The turning basin would be dredged the same depth as the channel since, during the pilot’s simulation runs, the ship pilots tended to use the turning basin as part of the channel while they came up to speed. Analysis of ship factors detailed in Appendix A indicate that a –53-foot design dredged channel, and turning basin and berth would provide adequate clearance under most conditions. The 53-foot-deep design channel will be used as the dredged channel component to perform Phase 2 screening of alternatives 5, 6, 11, and 12. The final design depth will be determined following optimization analysis during Phase 3 formulation. During Phase 3 formulation, an analysis will be performed to determine whether it would be economically more efficient to perform part of the planned future maintenance dredging as part of the initial channel dredging. This additional increment of dredging is referred to as the “Required Overdepth Dredging for Efficient Maintenance” (RODFEM) and has been included in the Phase 2 formulation.

3.20.5.2. Channel Location, Alignment, and Configuration

The channel for deep-draft access to Portsite is nearly perpendicular to the bathymetry contours with the berth aligned parallel with the channel at a bearing of N72°38'27"E. The alignment is parallel with the trestle-dock alignment and offset to the northwest 280 feet. The configuration of the dredged channel, turning basin, and berthing area was discussed earlier in Section 3.9.4.5. Ship pilots preferred the ship bow to face seaward for a quick departure when weather conditions make it unsafe to remain at the dock. The turning basin facilitates fully loaded fuel tankers and Panamax bulk carriers to approach the dock and turn to dock with the bow seaward.

3.20.5.3. Channel Dredging

The channel dredging volume varies with channel depth and distance from shore. The initial channel would be dredged with a side slope of 1 vertical to 3 horizontal. The material to be dredged has been characterized as medium to firm material with pockets of soft material. It is anticipated that the material would lay back in the short term to a 1 vertical to 10 horizontal slope. The channel has been located such that the 1:10 layback will not impact the existing sheetpile cells at the lightering barge loading facility. In addition to the initial dredging quantities, each optimization case investigated will include a volume of about 1,900,000 yd^3 of advance maintenance dredging. This dredging would remove an additional 2 feet of depth from the seaward end of the channel to the –43-foot depth contour (about 5,500 feet seaward of the dock area) and 5 feet of depth from the –43-foot contour to the shoreward limit of dredging. Two dredging estimates were prepared (one estimate used a fleet of clamshell dredges and the other a combination of clamshell and suction hopper dredges) with the lower cost estimate for combination dredges being used for plan formulation. Cutterhead dredges were considered possibly unreliable for use at Portsite because of the short construction season, lack of wave protection, and the rapid progression of weather systems through the area. As more information is developed by design studies, cutterhead dredges may be reconsidered.

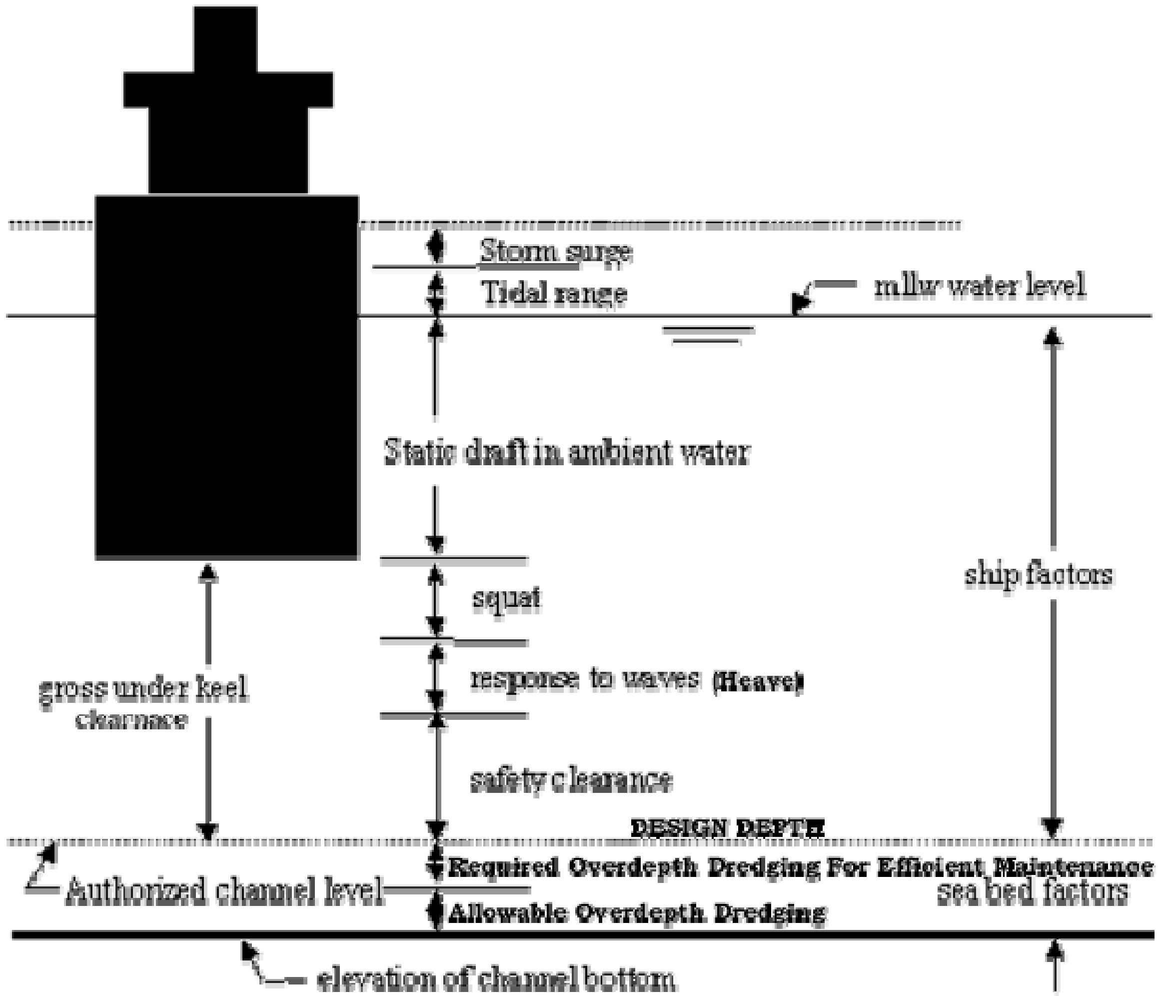

Figure 28. Channel Depth Design Factors

3.20.5.4. Dredge Disposal Site

The dredged material disposal site, selected for potential Ocean Dredged Material Disposal Site designation, is a rectangular 5,600-acre-area about 2 miles by 4-1/3 miles located 5 to 7 miles offshore (west-southwest) from the deep-draft dock (figure 29). The sea bottom in the area ranges from –62 to –72 feet MLLW. The site is deep enough for disposed of materials to not adversely affect navigation or coastal hydraulics. Strong currents in the disposal area would spread the materials from the dump location. The overall composition of the expected dredged material is 65 percent fines, 25 percent sand, and 10 percent gravel. Standard methods of dredged material disposal from barges/scows and hopper dredges are anticipated. Material would be placed in the site based on a total lift thickness limit of 5 feet and a target maximum elevation of –57 feet MLLW.

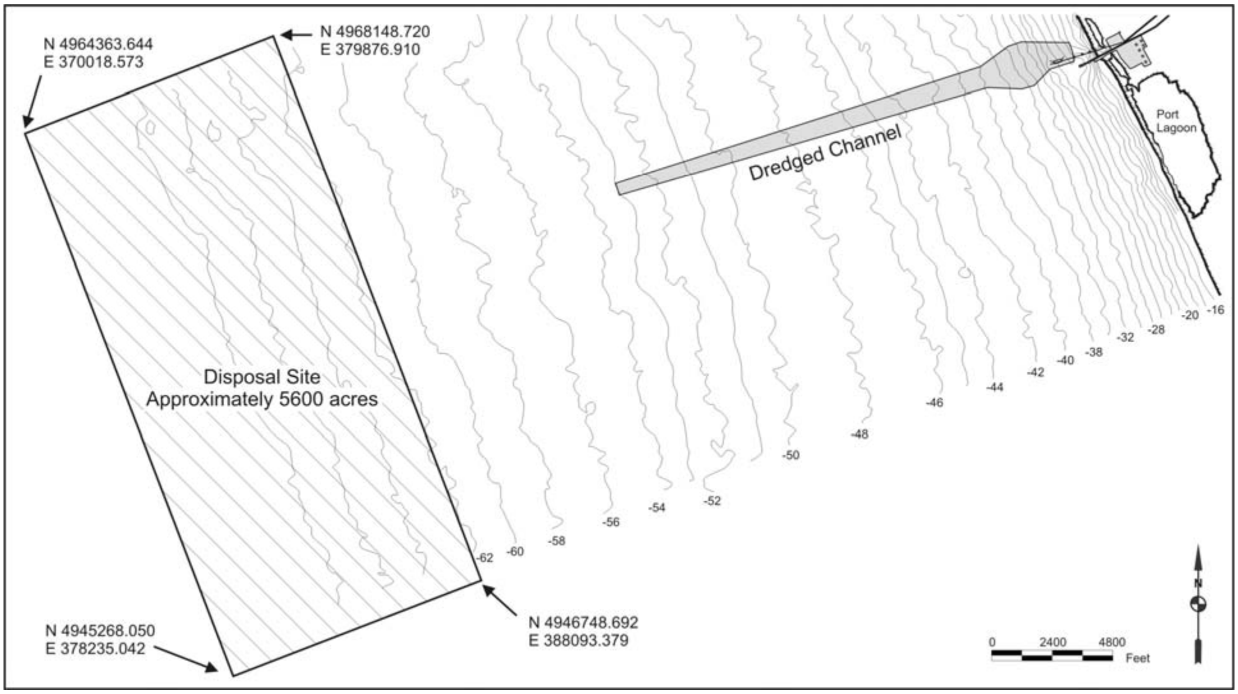

Figure 29. Offshore disposal site

3.20.5.5. Trestle and Dock Design

The new trestle would begin at the surge bin connecting conveyors P8 and P10 just south of the Personnel Accommodation Complex at Portsite. From there, a new enclosed concentrate conveyor, P10A, would extend for 1,000 feet to the beginning of the steel truss trestle. (Dimensions given are for the nominal 1,450-foot trestle.) The shoreward end of the trestle would be located on a cellular steel sheetpile cell. The steel truss trestle would have spans of about 300 feet and would be supported by piles driven into two circular sheetpile cells (located 300 and 600 feet seaward of the landward end of the trestle) and two conical piers (located 900 and 1,175 feet seaward of the landward end). The through truss would support an 18-foot-wide, two-lane small vehicle road (single lane for container transporters) and an initial enclosed concentrate conveyor on top of the truss, with space to include a second enclosed conveyor at some time in the future. The truss itself would be 20 feet wide and 30 feet high above the pier and extend 1,450 feet to the shoreward shiploader on the jackup dock. The prefabricated jackup dock (figure 30) would be supported by five conical piers, have two fixed radial shiploaders servicing the ship berth, and provide a dock area of about 300 feet by 90 feet for loading and offloading of general cargo.

Construction of the land-based facilities and trestle and dredging and disposal of sediment to create the channel would cause minor and localized adverse impacts to vegetation, wetlands, air quality, and marine resources. It would also introduce additional noise, minor adverse impacts to local cultural and visual resources, and potentially significant impacts to subsistence activities. After construction, operation and maintenance of the new facilities would continue to adversely impact some local resources but would substantially reduce the amount of ore concentrate released during the loading process, reduce fuel usage and marine-based noises, and improve regional air quality. This alternative would include mitigation measures M1, M2, M4, M5, M6, M8, M9, M11, M13, M14, and M16 from table 22 (and possibly M19 and/or M20).

3.20.5.6. Alternative 5 Formulation

Based on the vessel simulation model, is expected to be about 8 weather days at Portsite annually that would interrupt lightering barge operations, resulting in a combined total delay queue time for the bulk carriers of 29 ship-days. The sponsor's consultant estimates that, based on the hindcast and other hydraulic analyses, Portsite would be able to meet its commodity projections 100 percent of the time in the future. The NED net benefits were $6,225,848 based on high first costs, estimated at $227, 715,684 with annual OMRR&R costs of $7,795,705.

The Trestle-Channel Alternative provides for both concentrate and general cargo movement, but not fuel, and is not economically justified. This alternative was complete and effective only for concentrate and not for fuel. It was neither efficient nor acceptable. Therefore, the Trestle-Channel alternative was screened out in Phase 2 formulation.

3.20.6. Tunnel-Channel – Alternative 6

This alternative would be similar to Alternative 5, except that an access tunnel 2,850 feet long would replace the steel truss trestle of Alternative 5 (figure 31). This new mid-size bore tunnel leading to a dock would extend into deeper water than the existing dock and would be constructed so that it would not interfere with operation of the existing facilities during construction. The tunnel would carry conveyor systems, a tram, and utilities from the shore to the dock. The dock would support concentrate shiploaders. From the dock seaward, a channel would be dredged to deep-water in the Chukchi Sea.

Construction of the land-based facilities and tunnel and dredging and disposal of sediment to create the channel would cause minor and localized adverse impacts to vegetation, wetlands, air quality and marine resources. It would also introduce additional noise, minor adverse impacts to local cultural and visual resources, and potentially significant impacts to subsistence activities. If it could be constructed, operation and maintenance of the new facilities would continue to adversely impact some local resources but would substantially reduce the amount of ore concentrate released during the loading process, reduce fuel usage and marine-based noises, and improve regional air quality. Mitigation measures would be similar to Alternative 5.

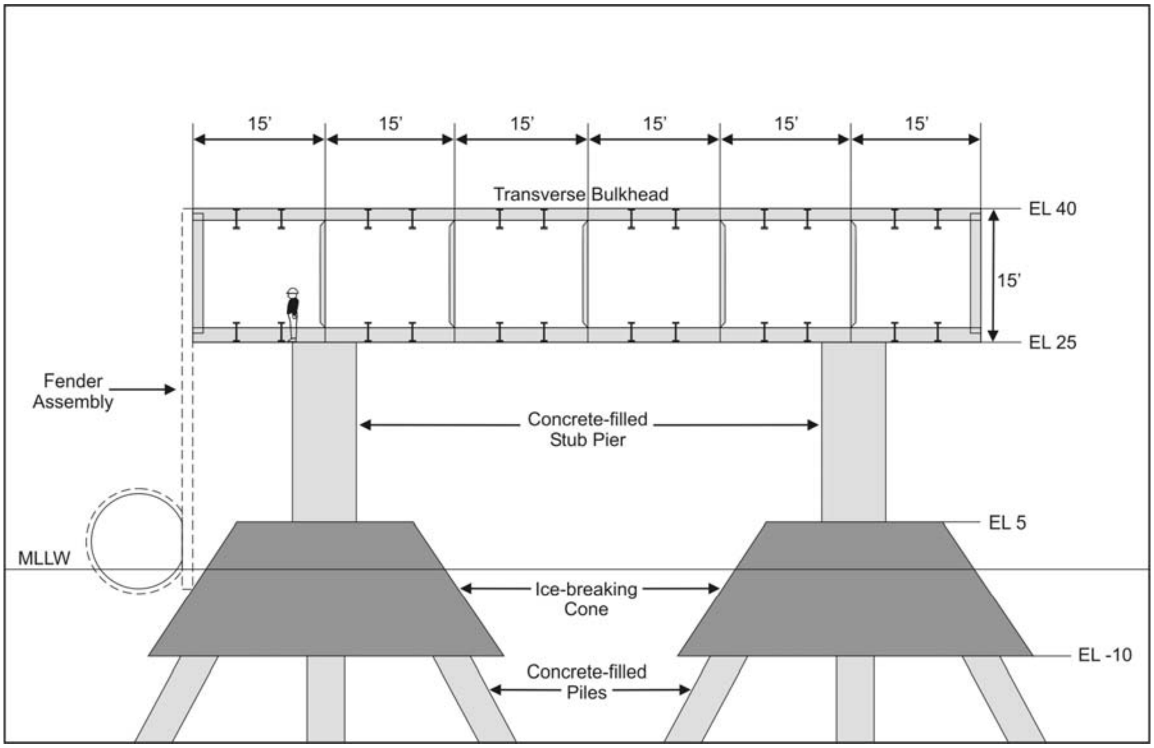

Figure 30. Jackup dock structure

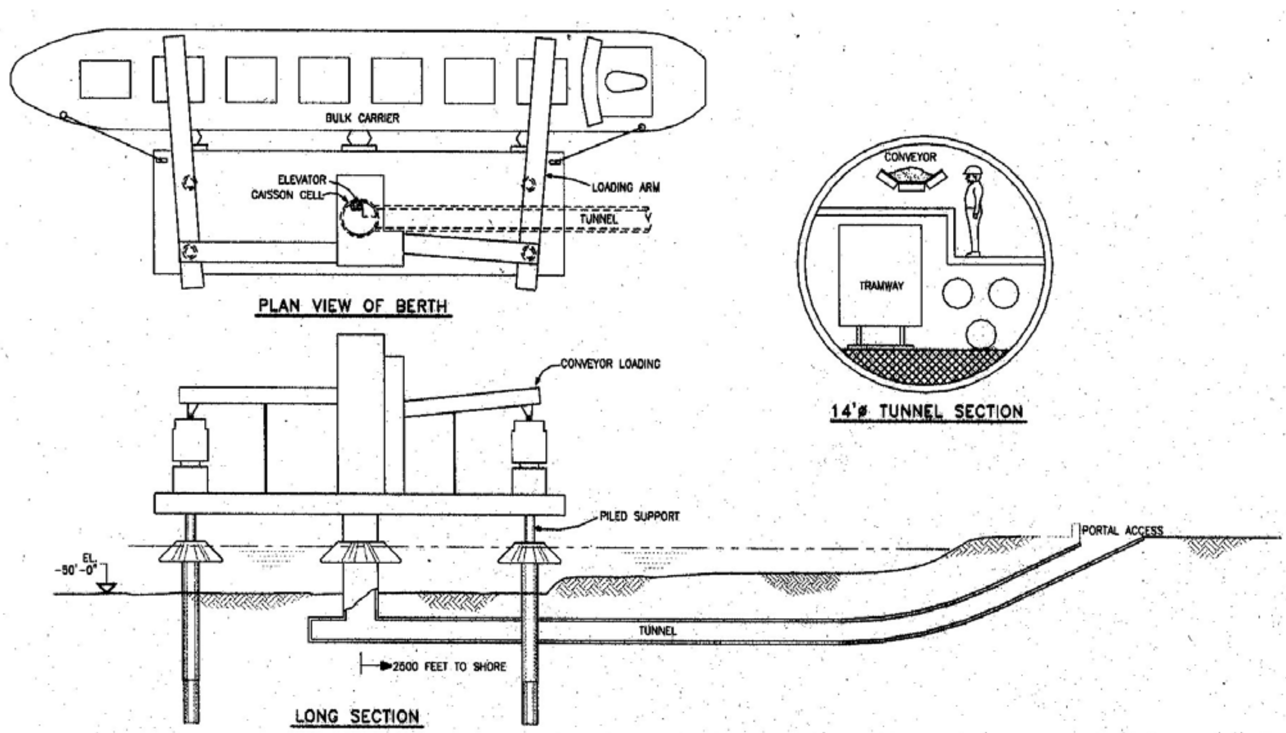

Figure 31. Tunnel channel alternative

A check was made to see whether a tunnel would be competitive with the trestle. A 14-foot-diameter bored tunnel carrying a walkway, the concentrate conveyor, and a small, personnel tram would have a first cost about $37.7 million more than the comparable length steel truss trestle. If the costs of a mobile crane, bulldozer, and other equipment necessary for operation and maintenance are included, the first cost of a tunnel would be about $40 million more than the steel truss plan. In addition, constructing and operating the vertical lift concentrate bucket system at the dock under arctic conditions would be very challenging. In fact, there are no bucket elevators of this size and capacity currently operating anywhere in the world. Whether or not such an elevator could be designed to efficiently and effectively operate in the arctic environment is probable but not definite. The operation and maintenance costs for a tunnel would be greater than the steel truss, but a fully reliable estimate has not been developed. The facility would also have (1) much reduced capability, compared with the trestle alternative, with no vehicle access for moving general cargo, (2) much reduced personnel access for normal operations, maintenance, and emergency medical response, and (3) no provision for the possible addition of a second conveyor at sometime in the future. Therefore, since Alternative 6 may be incomplete, possibly technically questionable to build, not very effective, and neither efficient nor acceptable, it was screened out in Phase 2 formulation.

3.20.7. Offshore Tanker Facility – Alternative 7

The deep-draft tanker fuel facility would consist of new pumping facilities located near the south end of the container laydown area, a pipeline running from the new pumps to the offshore off-loading facility, and the offshore facility (figure 32). The 20-inch pipeline would be placed using a horizontally drilled tunnel for the first 2,500 feet seaward from the pumping facility, and a cut and cover section for the remainder of the distance to the fuel transfer facility, about 11,000 feet offshore. The drilled-tunnel design was used for the first segment rather than a cut and cover design for the entire pipeline as a mitigation measure to avoid adverse environmental impacts at a cost of about $1 to $2 million. The fuel transfer facility itself would consist of six mooring buoys to hold the tanker in place, a mooring line launch, and the flexible hose connection, which each tanker would raise from the ocean floor to hook up to its manifold. The tankers would tie off to mooring buoys using the assistance of a mooring launch. The ship's machinery would then raise the flexible pipe and connect it to the ship's manifold. The fuel would then be pumped to the Portsite fuel storage tanks for use by TCAK or for transshipment to northern and western arctic villages using the existing fuel manifolds on the south concentrate barge berth. When the tanker offloading procedure is completed, the ship's machinery would return the flexible pipe to the ocean floor. The elements of this alternative above the seabed (flexible hose and buoys) would be removed at the end of each shipping season, stored on land, and reinstalled at the beginning of the next shipping season. An additional 1.5-million-gallon gasoline storage tank would be added to the existing DMT tank farm.

Construction of the land-based facilities and buried pipeline and dredging and disposal of sediment to create the trench and channel would cause minor and localized adverse impacts to vegetation, wetlands, air quality, and marine resources. It would also introduce additional noise, minor adverse impacts to local cultural and visual resources, and potentially significant impacts to subsistence activities. This alternative would create new, hardened-bottom habitat that does not currently exist near Portsite. If it could be constructed, operation and maintenance of the new facilities would continue to adversely impact some local resources but would lower the overall risk of fuel spills. This alternative would include mitigation measures M1, M2, M9, M10, M12, M15, M16, M17, M18, and M19 from table 22.

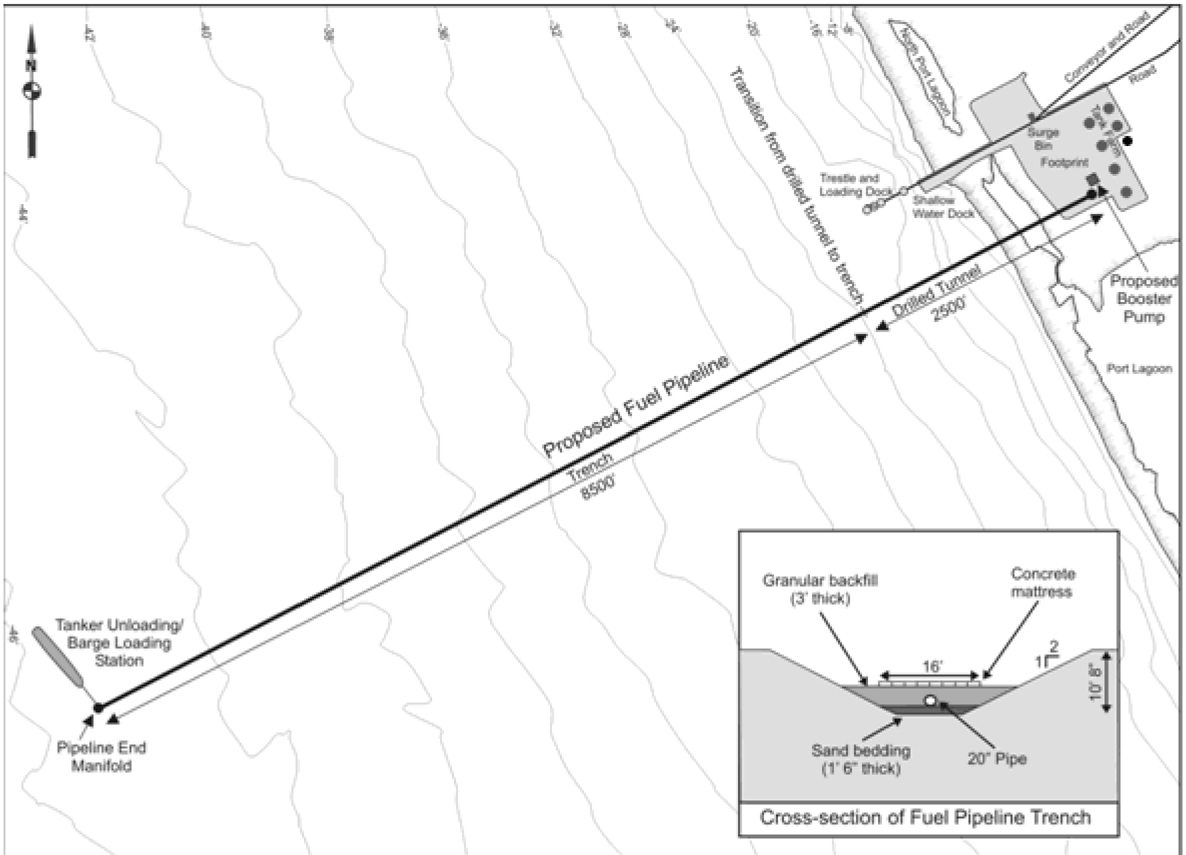

Figure 32. Tanker fuel facility

The first cost of the tanker facility is estimated at $85,295,479 (October 2004 price level) with an annual OMRR&R cost of $3,824,314. When amortized over the 50-year economic analysis period at the 5-3/8 percent interest rate, the average annual costs are $9,032,025. The ship simulation model results indicate that fuel costs would be lowered by $11,002,400, resulting in average annual net NED benefits of $1,970,375 and a benefit-to-cost ratio of 1.22 to 1.0. Due to the underwater placement of the single pipeline, any maintenance and repairs needed would be very costly and time consuming. Therefore, the reliability of this fuel offloading system would not be directly comparable to a system with piping above water level where relatively easy access is available for repair and replacement. If any bulk carrier were to drop anchor on the buried pipeline or drag its anchor across the pipeline during a severe windstorm, the line could be out service for the remainder of the season due to the difficulty of mobilizing for repairs in this remote area.

This alternative would only deal with moving fuel and does nothing to improve concentrate or general cargo movement. While complete and effective for fuel and yielding net benefits greater than costs, it does not address concentrate and general cargo movements. Nevertheless, it yields annual benefits of $11 million on an $85 million initial investment. However, both Alternative 9 that combines this alternative with a breakwater, and Alternative 11 that combines this alternative with the trestle-channel option may have greater

NED economic benefits while addressing both concentrate and fuel. Therefore, this alternative was screened out in Phase 2 formulation as less complete, efficient, and acceptable than Alternative 9 or Alternative 11.

3.20.8. Third Barge and Offshore Tanker Facility– Alternative 8

This alternative would combine the measures that make up alternatives 2 and 7. We have already seen that Alternative 2 has negative net benefits. Therefore, unless there would be an overriding synergistic effect, which is not the case here, the combination will not be as good as Alternative 7 by itself. Based on the vessel simulation model, there is be expected to be about 34 weather days at Portsite annually that would interrupt lightering barge operations, resulting in a combined total delay queue time for the bulk carriers of 200 ship-days. The sponsor's consultant estimates that, based on the hindcast and other hydraulic analyses, Portsite would be able to meet its commodity projections about 94 percent of the time in the future.

Adding a third barge and tugs to accompany it would not alter loading operations or associated fugitive dust emissions. Fuel consumption and associated exhaust emissions would increase by a small percentage due to the annual mobilization, operation, and demobilization of the third barge and the tugs needed to support it; additional barge conflicts at the loader, dock, and navigation lanes; and an incremental increase in hoteling near Portsite. Construction of the land-based facilities and tunnel and dredging and disposal of sediment to create the channel would cause minor and localized adverse impacts to vegetation, wetlands, air quality, and marine resources. This alternative would create new, hard-bottom habitat that does not currently exist near Portsite. It would also introduce additional noise, minor adverse impacts to local cultural and visual resources, and potentially significant impacts to subsistence activities. After construction, operation and maintenance of the new facilities would continue to adversely impact some local resources but would lower the overall risk of fuel spills. The mitigation measures would be the same as Alternative 7.

The average annual net benefits are about $790,000, which is a reduction of $1,180,000 from Alternative 7. Since this alternative has less net benefits than Alternative 7, which has already been screened out in preference to Alternative 9, Alternative 8 is screened out of Phase 2 formulation.

3.20.9. Breakwater and Offshore Tanker Facility – Alternative 9

This alternative would combine the measures that make up alternatives 3 and 7. The ore concentrate loading process would remain unchanged but the loss of ore concentrate at the loading dock may be slightly reduced by improved loading conditions . Construction of a breakwater and offshore tanker facility would bury existing biological resources and cause minor and localized adverse impacts to other marine resources and air quality, but would create new, rock-based, and bottom-hardened habitat that does not currently exist near Portsite. After construction, maintenance and operation of the facilities would continue to cause smaller scale impacts. After construction, operation and maintenance of the new facilities would continue to adversely impact some local resources but would lower the overall risk of fuel spills. Limited impacts to cultural, visual, and subsistence resources or activities would also be anticipated. Mitigation measures for this alternative would include M1, M2, M8, M9, M11, M13, M14, M15, M16, M17, and M18 from table 22.

The first cost of the breakwater combined with the tanker facility is estimated at $149,142,747 (October 2004 price level) with an annual OMRR&R cost of $4,249,467. When amortized over the 50-year economic analysis period at the 5-3/8 percent interest rate, the average annual costs are $13,465,414. The ship simulation model results indicate that delays would be reduced and transportation costs lowered by $15,564,800, resulting in average annual net NED benefits of $2,099,386 and a benefit-to-cost ratio of 1.16 to 1.0.

This alternative improves moving fuel and concentrate more efficiently. Because the breakwater would also shield the shallow-water dock, there may some benefits associated with reduced delays for existing fuel and cargo operations. However, these are not significant and have not been estimated. While complete and effective for fuel and concentrate, yielding net benefits significantly greater than costs, it does not address general cargo movements. Nevertheless, it yields annual benefits of $15.6 million on a $149 million initial investment. Therefore, this alternative will be retained for Phase 3 formulation.

3.20.10. Third Barge, Breakwater, and Offshore Tanker Facility– Alternative 10

This alternative would combine Alternative 4, which is the combination of alternatives 2 and 3 with Alternative 7. Adding a third barge, tugs to accompany it, and a breakwater would not significantly alter ore concentrate loading operations but the loss of ore concentrate at the loading dock may be slightly reduced by improved loading conditions. Fuel consumption and associated exhaust emissions would increase by a small percentage due to the annual mobilization, operation, and demobilization of the third barge and the tugs needed to support it; additional barge conflicts at the loader, dock, and navigation lanes; and an incremental increase in hoteling near Portsite. After construction, operation and maintenance of the new facilities would continue to adversely impact some local resources but would lower the overall risk of fuel spills. This alternative would create new, hard-bottomed and rock-based habitat that does not currently exist near Portsite. The additional barge and tugs would be new sources of sound, but would not make any appreciable difference in the strength of sounds in the water around Portsite or the distances those sounds could be heard. Limited adverse impacts to cultural, visual, and subsistence resources or activities would also be anticipated. Mitigation measures would be the same as Alternative 9.

We have already seen that Alternative 4 has negative net benefits. Therefore, unless there would be an overriding synergistic effect, which is not the case here, the combination of alternatives 4 and 7 will not be as good as Alternative 7 by itself. Based on the vessel simulation model, there is expected to be about 3 weather days at Portsite annually that would interrupt lightering barge operations, resulting in a combined total delay queue time for the bulk carriers of 34 ship-days. The sponsor’s consultant estimates that, based on the hindcast and other hydraulic analyses, Portsite would be able to meet its commodity projections 100 percent of the time in the future. The average annual benefits are $15,760,100 and the annual net benefits are -$1,442,145. This is a reduction in net benefits of about $3.4 million from Alternative 7 by itself. Since this alternative has less net benefits than Alternative 7, which has been screened out in preference to Alternative 9, it is screened out in Phase 2 formulation.

3.20.11. Trestle-Channel-Tanker Facility– Alternative 11

This alternative would add the capability to service deep-draft tankers to Alternative 5, which is composed of an access trestle, deep-draft concentrate shiploading dock, and dredged channel. The addition of a 12-inch pipeline and fuel transfer facilities to the concentrate trestle and dock would be very easy. The pipeline can be placed on top of, in, or under the truss carrying the roadway and the enclosed conveyor. The shoreside facilities needed for Alternative 7 would be included. An additional 1.5-million-gallon gasoline storage tank would be added to the existing DMT tank farm.

This alternative would combine a pipeline and fuel transfer facilities to the concentrate trestle and dock. The pipeline can be placed on the trestle. Construction of the land-based facilities and trestle and dredging and disposal of sediment to create the channel would cause minor and localized adverse impacts to vegetation, wetlands, air quality, and marine resources. It would also introduce additional noise, minor adverse impacts to local cultural and visual resources, and potentially significant impacts to subsistence activities. After construction, operation and maintenance of the new facilities would continue to adversely impact some local resources but would substantially reduce the amount of ore concentrate released during the loading process, reduce fuel usage and marine-based noises, improve regional air quality and lower the overall risk of fuel spills. This alternative would include mitigation measures M1, M2, M4, M5, M6, M8, M9, M11, M13, M14, M15, and M16 from table 22 (and possibly M19 and/or M20).

The first cost of the combined project is about $4.7 million more than the trestle without fuel capability. The net NED benefits were $4,559,392. The first costs were estimated at $230,419,771 with annual OMRR&R costs of $7,822,000. The Trestle-Channel-Tanker Alternative provides for concentrate, general cargo movement, and fuel, and is economically justified. This alternative is complete, effective for concentrate, fuel, and general cargo, efficient, and acceptable. It yields annual benefits of almost $27 million on a $230 million initial investment. Therefore, the Trestle-Channel-Tanker Alternative will be retained for Phase 3 formulation.

3.20.12. Tunnel-Channel-Tanker Facility – Alternative 12

This alternative would add the capability to service deep-draft tankers to Alternative 6, composed of an access tunnel, the deep-draft concentrate shiploading dock, and dredged channel. The addition of a pipeline and fuel transfer facilities to the concentrate tunnel and dock would be relatively easy. The pipeline can be placed on top of or under the conveyor or the tramway in the tunnel. The shoreside facilities needed for Alternative 7 would be included. An additional 1.5-million-gallon gasoline storage tank would be added to the existing DMT tank farm.

Construction of the land-based facilities and tunnel and dredging and disposal of sediment to create the channel would cause minor and localized adverse impacts to vegetation, wetlands, air quality, and marine resources. It would also introduce additional noise, minor adverse impacts to local cultural and visual resources, and potentially significant impacts to subsistence activities. If it could be constructed, operation and maintenance of the new facilities would continue to adversely impact some local resources but would substantially reduce the amount of ore concentrate released during the loading process, reduce fuel usage and marine-based noises, improve regional air quality, and lower the overall risk of fuel spills. Mitigation measures for this alternative would be similar to Alternative 11.

A check was made to see whether an access tunnel 2,850 feet long would be competitive with the trestle. The medium bore tunnel carrying a walkway, the concentrate conveyor, a personnel tram, a fuel pipeline, and including the crane and bulldozer for operation and maintenance would have a first cost at least $50 million more than the comparable length steel truss trestle. In addition, constructing and operating the vertical lift concentrate bucket system at the dock under arctic conditions would be very challenging. In fact, there are no bucket elevators of this size and capacity currently operating anywhere in the world. Whether or not such an elevator could be designed to efficiently and effectively operate in the arctic environment is not known. The operation and maintenance costs for a tunnel would be greater than the steel truss, but a fully reliable estimate has not been developed.

The facility would also have much reduced capability compared with the trestle alternative, with no vehicle access for moving general cargo, much reduced personnel access for normal operations, maintenance, and emergency medical response, and no provision for the possible addition of a second conveyor at sometime in the future. Therefore, since Alternative 12 may be incomplete, possibly technically questionable to build, not very effective, and neither efficient nor acceptable, it was screened out in Phase 2 formulation.

3.20.13. Summary of Phase 2 Formulation

During Phase 2 formulation, 12 alternatives were considered, evaluated, and compared. Of those, eight were dropped from further consideration because they failed one or more of the four primary evaluation criteria: completeness, effectiveness, efficiency, and acceptability. Tables 24 and 25 provide a summary of these alternatives and their screening. Alternatives 1, 2, 9, and 11 will be carried into Phase 3 plan formulation.

Table 24. NED Comparison Of Phase 2 Formulation Alternatives

Alternative	First Cost ($M)	O&M Cost ($M)	Average Annual Cost ($M)	Average Annual Benefits ($M)	Net Annual Benefits ($M)	B/C Ratio
1– No Action	–	–	–	–	–	n/a
2 – Third Barge	24.0	2.325	3.737	2.554	-1.183	0.68
3 – Breakwater	69.6	0.425	4.782	4.562	-0.219	0.95
4 – Third Barge + Breakwater	93.7	2.750	8.518	4.758	-3.776	0.56
5 – Trestle-Channel	227.7	7.796	22.163	15.937	-6.226	0.72
6 – Tunnel-Channel	265.4	8.130	24.879	15.937	-8.942	0.64
7 – Tanker Facility	85.3	3.824	9.032	11.002	1.970	1.22
8 – Third Barge + Tanker	109.3	6.150	12.766	13.556	0.790	1.06
9 – Breakwater + Tanker	149.1	4.249	13.465	15.565	2.099	1.16
10 – Third Barge + Breakwater + Tanker	173.2	6.575	17.202	15.760	-1.442	0.92
11 – Trestle-Channel + Tanker	231.4	7.796	22.339	26.899	4.559	1.20
12 – Tunnel-Channel + Tanker	280.2	8.130	25.811	26.899	1.088	1.04

Table 25. Criteria Comparison Of Phase 2 Formulation Alternatives

Alternative	Concentrate Movement	Fuel Movement	General Cargo Movement	Provisions for 2nd conveyor	Complete?	Effective?	Efficient?	Acceptable?	Comment
1 – No Action	No Change	No Change	No Change	No	n/a	n/a	n/a	Maybe	Include in Phase 3
2 – Third Barge	Cost Increase	No Change	No Change	No	YES	NO	NO	NO	Include in Phase 3 non-structural plan
3 – Breakwater	Improves	No Change	No Change	No	YES	Partial	B/C>1	Maybe	Include in Phase 3
4 – Third Barge + Breakwater	Improves	No Change	No Change	No	YES	Partial	NO	NO	Screen out – B/C < 1
5 – Trestle-Channel	Improves a lot	No Change	Improves a little	Yes	YES	Partial	NO	NO	Screen out – B/C < 1
6 – Tunnel-Channel	Improves a lot	No Change	No Change	No	No	Partial	N/a	NO	Screen out – technical reasons
7 – Tanker Facility	No Change	Improves a lot	No Change	No	YES	Partial	B/C>1	Maybe	Screen out – Alternative 9 is better
8 – Third Barge + Tanker	Cost Increase	Improves a lot	No Change	No	YES	Partial	B/C>1	NO	Screen out – Alternative 7 is better
9 – Breakwater + Tanker	Improves	Improves a lot	Improves a little	No	YES	YES	B/C>1	YES	Include in Phase 3
10 – 3rd Barge + Breakwater + Tanker	Improves	Improves a lot	Improves a little	No	YES	YES	B/C>1	NO	Screen out – Alternative 9 is better
11 – Trestle-Channel-Tanker	Improves A lot	Improves a lot	Improves a little	Yes	YES	YES	B/C>1	YES	Include in Phase 3
12 – Tunnel-Channel-Tanker	Improves a lot	Improves a lot	No Change	No	No	Partial	N/a	NO	Screen out – technical reasons

4.0 COMPARISON AND SELECTION OF PLANS

4.1. Purpose of Section 4

The purpose of this section of the draft IFR is to complete the discussion of the plan formulation, alternative designation, and plan selection process. This section provides additional more detailed information on each of the four final detailed alternatives and completes steps 5 and 6 of the planning process. It compares and evaluates the alternatives, their benefits, costs, potential impacts, and possible effects. Different plans are designated and one plan, Alternative 11, is designated the tentatively recommended plan.

4.2. Description of Final Detailed Alternatives

4.2.1. Alternative 1 – No Action (Without-Project Condition)

The No-Action Alternative is defined as a continuation of existing conditions or the addition of a relatively small change that is due to be in place within a year or two, independent of the possible Federal project. For this study the No-Action Alternative is the without-project condition discussed in Section 3.6. This alternative would continue the current lightering system with the recently completed improvements implemented by TCAK under its Value Improvement Program. The four tug (Iver Foss–2,200 hp, Stacy Foss–3,000 hp, Sandra Foss–3,000 hp, and Fairwind–4,000 hp) and two lightering barge (*Kivalina* and *Noatak*) operation would continue with these or similar equipment. The ore concentrate loading process and fuel consumption, delivery, storage, and distribution operations would remain unchanged. There would be no short or long-term adverse or beneficial effects to environmental resources.

4.2.2. Alternative 2 – Third Barge (Non-structural Alternative)

For this alternative a third lightering barge with an additional 3,000 hp tug would be added to the existing operation to increase the reliability of achieving the annual throughput goals (see figures 6, 7, and 25). For ease of operation and maintenance, the new barge would be designed substantially the same as the existing two, self-unloading lightering barges. The self-unloading, non-ice class lightering barge would be 286 feet long, with a beam of 76 feet and molded depth of 18 feet. It would have a fabric cover for dust control and use front-end loaders operating on the deck to feed the unloading system, which would be an articulated conveyor. The custom aspect of the conveyor system causes the barge to be several times more expensive than a regular barge of similar capacity. Both the barge and the tug would be built in a shipyard, probably somewhere in the lower 48 states. The total number of marine transits would be expected to remain approximately the same. Loading of concentrate material would tend to shift to somewhat earlier in the shipping season. This is considered a "non-structural" alternative, because no major modification of the existing port facilities would be required. The new barge and tug first costs are estimated at $14.7 million and $4.5 million, respectively. The annualized life cycle cost for the additional barge and tug (including replacement of both at 25 years) is estimated at $3,736,831. Since construction and operation of a marine vessel to serve as a lightering barge is not considered under law a general navigation feature, all costs associated with implementation of such an alternative would be the responsibility of the non-federal sponsor, AIDEA.

Adding a third barge and tugs to accompany it would not alter loading operations or associated fugitive dust emissions. Fuel consumption and associated exhaust emissions would increase by a small percentage due to the annual mobilization, operation and demobilization of the third barge and the tugs needed to support it; additional barge conflicts at the loader, dock, and navigation lanes; and an incremental increase in hoteling near Portsite. Fuel delivery, storage, and distribution operations would remain unchanged. The additional barge and tugs would be new sources of sound and the increase in vessel traffic would result in a corresponding increase in spill potential related to their operation. However, the additional equipment would not make any appreciable difference in the strength of sounds in the water around Portsite or the distances those sounds could be heard and could be used to respond to larger spills should they occur. There would be no significant short or long term adverse or beneficial effects to environmental resources.

4.2.3. Alternative 9 – Breakwater and Offshore Tanker Facility

This alternative would combine Alternative 3, the breakwater (improves concentrate movement), with Alternative 7, the offshore tanker fuel facility (improves fuel transfer). For this alternative, a breakwater would provide a calm loading climate for the existing lightering barges at the barge loader, where the majority of the weather delays occur. The only delays that would be experienced following completion of the breakwater in the future would be when conditions prohibit the transit of the tug and lightering barge to the concentrate ship. TCAK shipping information for the 2000 season, when compared with 3-meter buoy wave records, indicates a 3.3-foot wave cut off for current barge loading operations, which occurs 18 percent of the time (5 to 7 days a month), based on the 15-year hindcast (July–October records). The existing cut off for the lightering barges loading the Panamax and Handysize bulk ships is a 6.6-foot wave, which occurs about 3.1 percent of the time (x to y days a month). The breakwater is designed to reduce a 6-foot wave at the barge loader, approaching the shoreline at 30 degrees, to a 3-foot wave, which would allow almost uninterrupted loading over the shipping season.

The 2,800-foot-long breakwater's centerline would be about 695 feet offshore of the seaward end of the seaward cellular sheetpile foundation at the barge loader, straddling the –24-foot MLLW contour (see figure 26). The sea bottom at the site is gently sloping with large areas of sand/silt interspersed with sand areas and sand/gravel areas. The breakwater would create a protected barge maneuvering area of 620 feet between the breakwater and the barge loader. The breakwater's top elevation would be +10 feet MLLW with a seaward slope of 1 vertical to 2 horizontal and a crest width of 18 feet. The breakwater (figure 33) would be constructed of armor rock (10-ton) 12 feet thick overlaying a 6.5-foot zone of bedding stone (2-ton) on a 3-foot-thick filter layer (400-pound stone). Since both ends of the breakwater would be more susceptible to wave and ice damage than the breakwater trunk, 22-ton stone would be used on the ends. The breakwater, composed of about 371,520 yd^3 of rock, would cover an area of sea bottom about 207 feet wide by about 3,020 feet long, which is about 625,000 square feet (14.4 acres). The stone for the breakwater could come from the quarry at Cape Nome. This configuration would be expected to overtop during storms, but is designed to survive a 50-year storm wave.

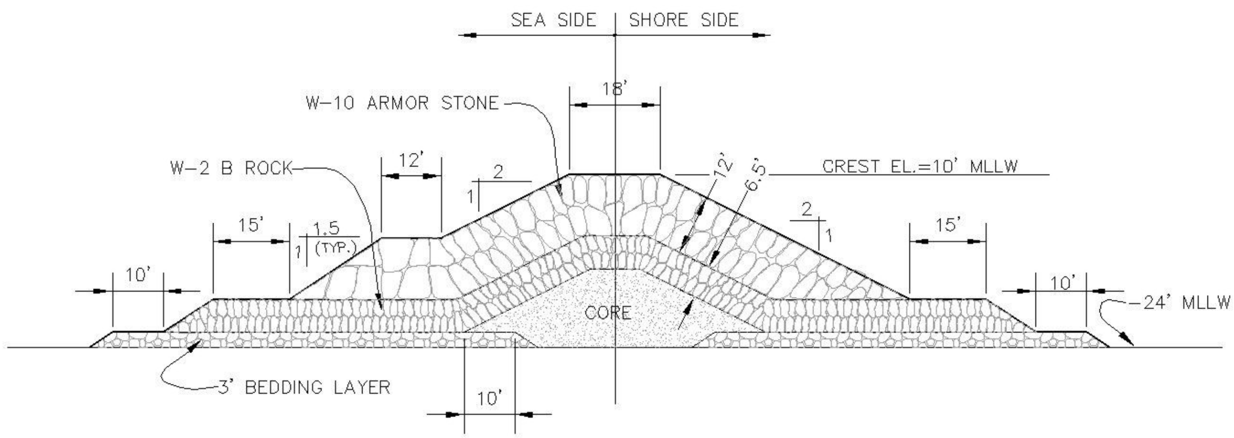

Figure 33. Typical breakwater cross section

Sediment bypassing of 26,000 yd^3 annually is required. No deep water disposal of dredged material is anticipated. Sediment accumulation landward of the breakwater would be cleaned out by tug prop wash. Maintenance of the breakwater is expected to require replacement of about 5 percent of the armor stones every 10 years. The breakwater is estimated to cost $69,639,452 (October 2004 price level), with an annual operation and maintenance cost of $425,153. Since construction and operation of a breakwater is considered under law a general navigation feature, costs associated with implementation of such an alternative would be shared between the Federal Government and the non-federal sponsor, AIDEA. The U.S. Coast Guard would be responsible for any navigational aids required for the breakwater. The Corps of Engineers would be responsible for the costs associated with the operation and maintenance of the breakwater.

The least expensive tanker facility would involve an offshore multi-buoy mooring facility, a pipeline end manifold with flexible riser hose to the ships' manifolds, and a pipeline under the seabed to the existing fuel tank farm at Portsite (see figure 34). The alignment of the pipeline and the exact location of the offshore fuel transfer facility would be shifted slightly to the southeast from that used for Alternative 7, so that the pipeline would not pass directly under the breakwater.

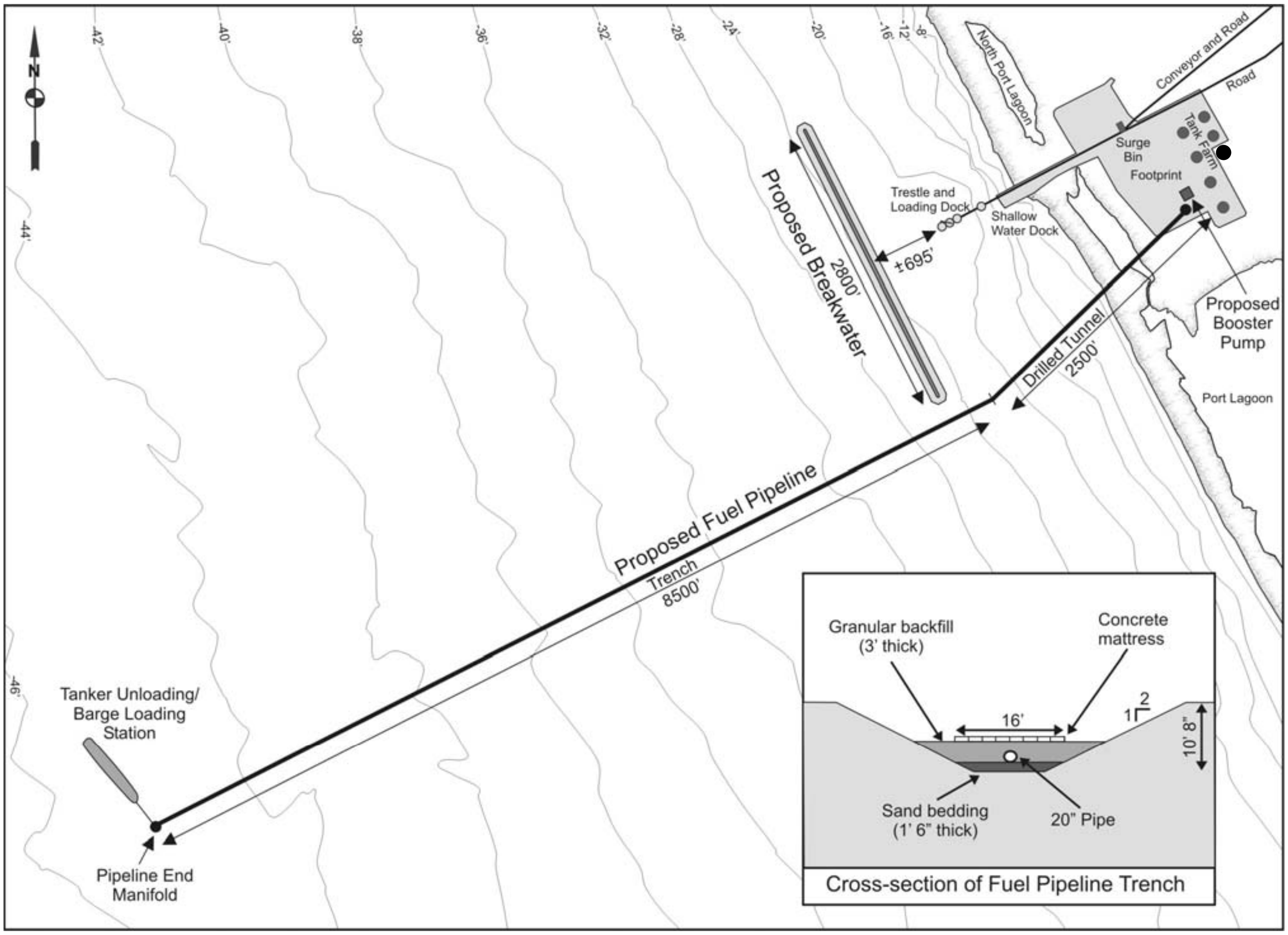

Figure 34. Breakwater and Fuel Facility

The design tanker is a 55,000 dwt, foreign-flag tanker, about 650 feet long and 107 feet wide that draws 40 feet fully loaded and 33 feet partially loaded. The tanker facility is estimated to receive 52,600,000 U.S. gallons of fuel per year through four deep-sea tanker visits. The existing fuel barge facility would be used to ship 30,100,000 U.S. gallons of fuel per year in 5,000,000 U.S.-gallon capacity or smaller tanker barges to villages in northwestern arctic Alaska. The breakwater would be constructed as described earlier in this section. The tanker facility is described in the following paragraphs.

The multi-buoy mooring arrangement (figure 35) is composed of a six point, spread mooring, each leg having anchors jetted/set into the seabed, stud-link chain, and a mooring buoy. A flexible pickup hose string would connect the pipe line end manifold located on the seabed to the manifold on tankers or barges, located amidships. The water depth required at the buoys is 43 feet, which is about 11,000 feet directly offshore of the existing Portsite tank farm. The underkeel clearance was reduced for the multi-buoy mooring arrangement based on the assumption that the fuel ships could wait for calm weather to unload its product. The mooring buoys would need to be removed before ice in the fall and re-installed each year at the beginning of the shipping season. Tanker moorings of this type are relatively common and are used at exposed ocean terminals near Los Angeles, California and Barber’s Point, Hawaii.

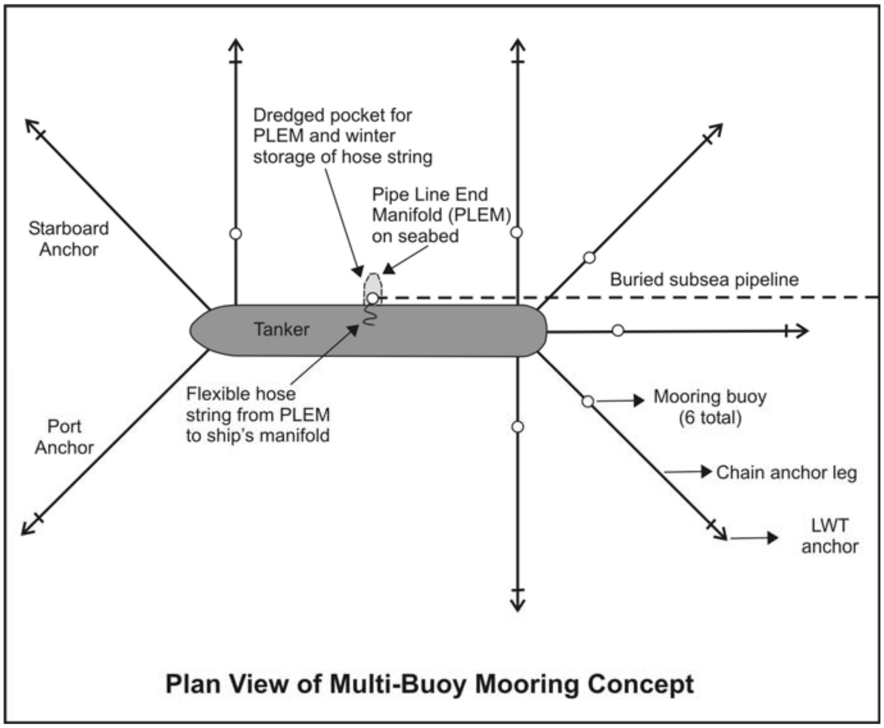

Figure 35. Multi-buoy mooring concept

The pipeline would be a 20-inch diameter, 1/4-inch thick steel pipe, connecting the tanker facility with the shore, from the offshore pipeline end manifold to the onshore tank farm. The pipe would have a three-layer polyethylene protection system with sacrificial anodes. At the end of each season, the pipe would be pigged and filled with inert gas in order to avoid any fuel spillage if ruptured during the off-season. The pipeline would be installed in two basic sections: (1) the near-shore 2,500-foot-long section and (2) the 8,500-foot-long offshore section. In order to not disturb the beach as mitigation measure M18, a horizontally directionally drilled (HDD) pilot tunnel would be used from the tank farm to the end of the sand and gravel layer about 2,500 feet offshore in water about –24 feet MLLW, where a "glory hole" would be excavated. Seaward of the hole, the pipe would be laid in an 8,500-foot-long trench on the seabed extending to the loading point. A concrete mattress would be laid over the backfill and pipeline to protect from ice scour and to prevent uplift. The trench for the pipeline would have about a 53-foot top width and 8,500-foot length, which affects 131,700 square feet (about 3 acres) of the seabed. About 117,000 yd^3 of bottom material would be excavated with disposal at a deep-water site or backfilled over the pipeline. The backfill of the trench would involve about 6,150 yd^3 of sand bedding and 17,950 yd^3 of granular material. The HDD tunnel would remove about 290 yd^3 of foundation materials.

Onshore facilities would be situated at the southern end of the container laydown area on the seaward side of the Portsite tank farm. These facilities would be constructed and shipped to Portsite at the beginning of the open water season to use as much offsite fabrication as possible and to minimize the erection time onsite. Installation and tie-in would be accomplished in parallel with the offshore activities. The main features of the onshore fuel transfer facilities would be (1) a booster pump with a standby pump, (2) a receiving facility for pigging the pipeline, (3) a custody transfer station, (4) electrical room, (5) spill response barge, and (6) a 1.5-million-gallon gasoline storage tank.

The total estimated first cost of the fuel transfer facility is $77,218,495 with annual operation and maintenance costs of $3,824,314. Thus, the total estimated first cost for Alternative 9 combining concentrate and fuel movement measures is $149,142,747 with the annual operation and maintenance costs totaling $4,249,467. The total average annual costs are $13,465,414 with total average annual benefits of $15,564,800. The net average annual benefits total $2,099,386 yielding a benefit-to-cost ratio of 1.16 to 1.0. Since construction and operation of an offshore fuel transfer facility is not considered under law a general navigation feature, all costs associated with implementation of the fuel facility would be the responsibility of the non-federal sponsor, AIDEA. The U.S. Coast Guard would be responsible for any navigational aids necessary for safe marine use of the tanker fuel transfer facility.

The ore concentrate loading process would remain unchanged but the loss of ore concentrate at the loading dock may be slightly reduced by improved loading conditions. Construction of a breakwater and offshore tanker facility would bury existing biological resources and cause minor and localized adverse impacts to water and air quality but would create new, rock-based habitat that does not currently exist near Portsite. After construction, annual bypass and periodic maintenance dredging efforts would continue to cause minor and temporary adverse impacts to local water and air quality but operation of the new facilities would lower the overall risk of fuel spills in the region by shifting some regional fuel delivery from barges to tankers and some lightering operations from floating sea-based operations in Kotzebue Sound to shore-based operations at the DMT. The breakwater would also present a new physical presence offshore that could impact local visual resources and may impact marine mammal behavior or migration, and/or change other conditions related to access to resources currently harvested for subsistence near Portsite.

4.2.4. Alternative 11 – Trestle-Channel-Tanker Facility

This deep-draft port facility would facilitate the export of base metal concentrates, the import and transshipment of fuel oil, and the import of general cargo. This alternative would provide (1) a new deep-draft, direct, concentrate loading dock with twin shiploaders serving a single berth at a dock located 1,450 feet offshore (figure 36), (2) a trestle carrying an enclosed concentrate conveyor from the surge bin onshore to the dock shiploaders with a vehicle roadway to move general cargo, and (3) a tanker fuel offloading facility and pipeline on the trestle to the existing fuel storage tanks onshore. An 18,574-foot-long channel would be dredged to a design depth of –53 feet MLLW from the dock to deep water in the Chukchi Sea. Disposal of dredged materials would be in an offshore disposal area about 30,000 feet southwest of the loading facility in waters between –62 and –72 feet MLLW.

The dredging and disposal of materials for both construction and operation and maintenance is considered a general navigation feature (GNF) (except berth dredging) and would be cost shared between the Federal Government and the local sponsor, AIDEA. The construction of the concentrate loading dock (including berth dredging) is considered a local service facility (LSF) and, as such, is entirely the responsibility of the non-federal sponsor. The following paragraphs will discuss the GNF and the LSF, in turn.

A detailed discussion of channel design can be found in Section 3.15.4.4. The channel design is a straight channel (see plate 3) that expands from 500 feet wide at its seaward end to an offset flare to the north of the centerline at the inshore end. A turning basin is located south of the flared channel. The berthing area is south of the channel immediately north of the dock. Since the prevailing current along the coast is to the north, the berth was placed on the north side of the dock to allow easier departure of loaded ships.

Several unique conditions challenge navigation at Portsite, including currents perpendicular to the channel, adverse winds, and an extremely short navigation period. Bulk concentrate ships and fuel tankers would enter the channel and proceed to the turning basin, where, with tug assistance, they would turn 180 degrees and back into the berth. On occasion, partially loaded ships may have to leave the berth due to an anticipated storm. After the storm, the partially loaded ship could return to the berth to complete loading/unloading. Occasionally, the concentrate ships or other vessels would offload general cargo or containers using the ships' equipment at the deep-draft dock. The factors that determine channel depth were discussed in Section 3.0.

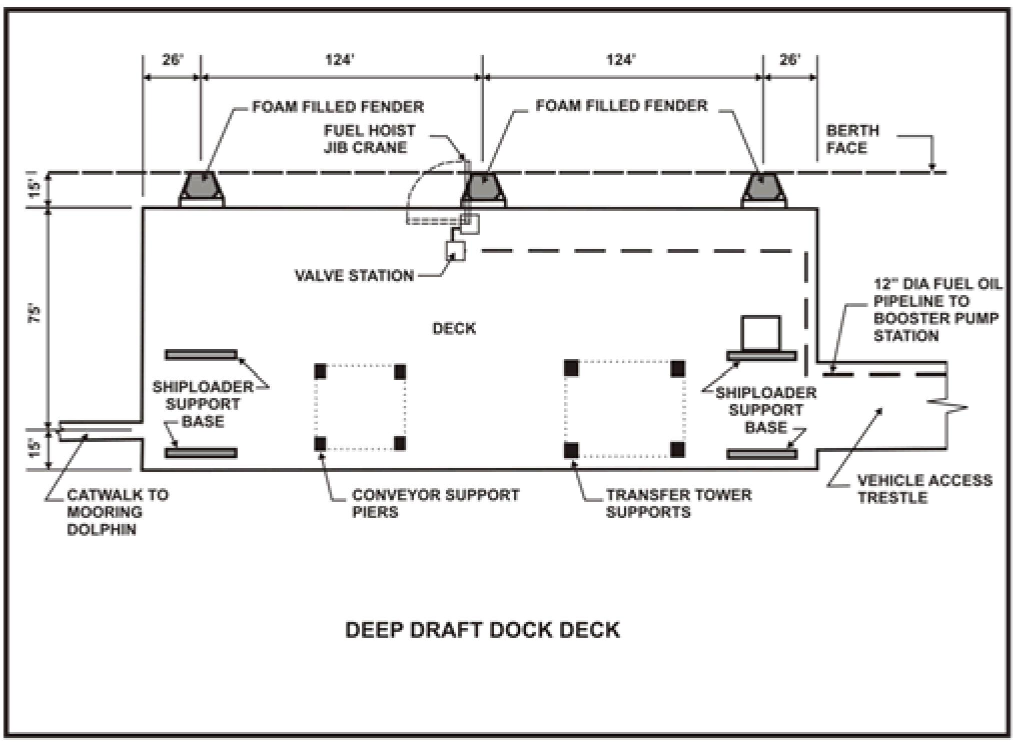

Figure 36. Deep draft dock deck

Costs and benefits were developed for different combinations of trestle length, dredging length, and dredging depth in order to optimize the net NED benefits of this alternative. The trestle-channel length combinations considered were (1) 1,450-foot trestle with 18,574-foot channel; (2) 2000-foot trestle with 17,800-foot channel; and (3) 2,600-foot trestle with 17,200-foot channel. Preliminary evaluations considered design channel depths of 42, 45, 47, 50, and 53 feet. Since these computations showed that the optimum depth would be at or near the 53-foot depth, the 42 and the 45-foot deep options were dropped from the final optimization analysis. Table 26 provides the information on the final optimization cases considered.

Table 26. Alternative 11 Optimization

Trestle Nominal Length (ft)	Dredging Length (ft)	Dredging Depth (ft) MLLW	First Cost ($M)	O&M Cost ($K)	Average Annual Benefit ($M)	Average Annual Cost ($M)	Annual Net Benefits ($M)	B/C Ratio
1,450	18,574	– 53	230.4	7.796	26.899	22.339	4.559	1.20
1,450	13,887	– 50	218.1	7.616	25.899	21.437	4.462	1.21
1,450	10,387	– 47	206.6	7.503	24.781	20.615	4.166	1.20
2,000	18,023	– 53	239.2	7.737	26.899	22.848	4.051	1.18
2,000	13,337	– 50	222.0	7.569	25.899	21.647	4.252	1.20
2,000	9,837	– 47	216.7	7.464	24.781	21.149	3.632	1.17
2,600	17,423	– 53	247.7	7.765	26.899	23.488	3.461	1.15
2,600	12,737	– 50	233.7	7.647	25.899	22.462	3.436	1.15
2,600	9,237	– 47	228.5	7.545	24.781	22.040	2.741	1.12

The maximum NED benefits were obtained with 1,450-foot trestle, 18,400-foot channel, dredged to a depth of 53 feet. No additional economic benefit is to be gained by looking at deeper dredging since there is no vessel traffic that needs a channel deeper than –53 feet. Also, the trestle has been shortened to the maximum extent feasible without moving the dredged channel into the shoreline littoral sediment drift zone, where dredging volumes, costs, maintenance problems, and impacts would rise significantly.

Based on a vessel draft of 45 feet, ship factors of 8 feet, and a 1-foot allowable overdepth dredging (added to the design depth to guarantee mariners at least depth equivalent to the ships factors because of inaccuracies inherent in dredging equipment.), the actual competed dredging depth would be 54 feet for a 53-foot design channel. This would allow fully loaded Panamax bulk carriers to leave the berth and 55,000 dwt tankers loaded to a 33-foot draft to approach the berth. The sponsor has indicated that they could use two 5,000 hp tractor tugs to assist concentrate ships at Portsite, since they would be potentially less expensive, being better suited to find off-season work.

The initial 53-foot channel would be dredged with a side slope of 1 vertical to 3 horizontal and would be expected to soon lay back to a 1 vertical to 10 horizontal slope. The total seabottom disturbed by dredging to the design depth with the 1:3 slopes is estimated at about 330 acres. If all the slopes lay back to the 1:10 slope, a total of about 400 acres would be affected. The initial dredging quantities total 8,141,374 yd^3, with the –53-foot MLLW channel estimated at 6,832,131 yd^3, the turning basin estimated at 723,260 yd^3, and the berthing area estimated at 585,983 yd^3. Because of the isolated location and the constraint that maintenance of the channel would have to take place at the same time as other vessel use of the channel, a maintenance sump of about 1,900,000 yd^3 (volume included in above dredging volumes) would be created by initially dredging the channel an additional 5 feet deep landward of Station 90+00 and an additional 2 feet deep seaward of that point. This maintenance dredging has an estimated average annual cost of $1,245,246. The sump would initially affect an additional 8 acres of seabottom, expanding up to a total additional 30 acres, if the slopes lay back to 1 on 10. Channel maintenance dredging would be expected to occur in years 5, 17, 33, and 49 of the project.

The Coast Guard will require a stationary navigational aid for the Portsite channel due to the distance to the nearest Coast Guard Station. The aid chosen for Portsite is a set of two range towers located on the channel centerline. One could be located on the beach berm with the second affixed to the roof of the new personnel accommodations complex.

Since the ocean going vessels would enter the 3-mile U.S. territorial limit, Customs, Immigration, and U.S. Coast Guard officials would usually be required to clear the vessel and crew upon arrival. The ship simulation model used to simulate ship movements assumes the need for a clearance period upon vessel arrival and departure (see Appendix F). The O&M costs developed for the economic analysis include provisions for two Customs/Immigration officials and two U.S. Coast Guard officials at the personnel accommodations complex.

The dredged material disposal area for channel construction and maintenance would be a 2-mile by 4-1/3 mile rectangular site located about 2 miles seaward of the seaward end of the dredged channel, about 5-1/2 miles southwest of Portsite. The seabed in the area varies from –62 feet to –72 feet MLLW and provides an area deep enough for disposal of the excavated materials without significant impacts on navigation or coastal hydraulics of the area.

Channel construction is anticipated to require 3 years to complete, assuming a contract award in the fall of the year. The total estimated first cost of the dredging is estimated at $74,967,149, with annual operation, maintenance, repair, replacement, and rehabilitation at $1,245,246. Since construction and operation of a dredged channel is considered under law a general navigation feature, GNF costs associated with implementation of such an alternative would be shared between the Federal Government and AIDEA. The costs associated with the required overdepth dredging required for efficient maintenance would be considered part of the general navigation features for cost sharing and cost shared in proportion to the relative volumes of the two cost sharing zones and the berth area. The U.S. Coast Guard would be responsible for any navigational aids required for the project. The costs associated with the operation and maintenance of a 45-foot-channel would be the responsibility of the Federal Government. The maintenance costs, which are greater than those that would have been experienced if the channel were limited to only 45-feet-deep, would be shared 50-50 between the Federal Government and the local sponsor.

The deep-draft channel ends at the –20-foot bottom contour along the deep-draft dock. The LSF required for the GNF to achieve the benefits projected by this analysis include both marine structures and onshore facilities. The primary marine structures include the deep-sea berth and dock, the trestle structure supporting the conveyor and roadway, and the marine foundations. The required upland features include (1) an abutment fill for the end of the trestle, (2) a conveyor system upgrade, and (3) improvements to the fire suppression and power generation systems, (4) improvements to the existing personnel accommodations, and (5) the addition of a 1.5-million-gallon gasoline storage tank to the existing DMT tank farm. These items will be discussed in turn in the following paragraphs. Since construction, operation, and maintenance of a deep-draft dock and necessary upland facilities are considered under law an LSF, all costs associated with implementation of such features would be the responsibility of AIDEA. The total estimated first cost of the local service facilities is $155,452,622 with annual OMRR&R costs of $6,550,459.

The deep-water berth has a dock with a service deck 90 feet wide by 300 feet long. The dock would support two shiploaders, conveyor gallery towers, and hydraulic/mechanical/electrical rooms, as well as a firewater storage tank inside the platform itself (see figure 36). The deck elevation is set at +40 feet MLLW for a safety clearance. Two fixed radial shiploaders would be located on the south side of the dock and would be capable of completely loading vessels ranging from 30,000 dwt to 75,000 dwt without the need to warp the vessels. Both shiploaders would have a belt capacity of 2,600 tph that satisfies the concentrate throughput requirements and matches the peak onshore equipment rates.

Deep-sea tanker vessels would be unloaded at the deep-water berth at a rate of 7,500 U.S. gpm. Fuel unloading facilities would be provided, including a 12-inch pipeline from the dock to the shore storage tanks. The fuel intended for the mine and port operation would be stored in the existing 15,000,000 U.S. gallon capacity storage tanks at Portsite along with any fuel intended for transshipment. Fuel can be distributed to local villages in the region by fuel barges that berth at the barge lightering dock or by larger ocean-going barges that could berth at the deep-water dock.

The deck provides for use by mobile maintenance equipment and general cargo handling equipment. The intention is to make it possible to use the deep-draft berth to handle limited quantities of general cargo that is less costly to procure overseas compared with North American sources. Ships’ equipment would be used to load and unload containers from the ships. Forklifts would move the containers around on the deck to position them for access by the ships’ cranes.

The access trestle from shore would consist of 5 spans of a through-truss bridge (figure 28). The first three trestle spans from shore would be 300 feet long, with the fourth and fifth spans being 275 feet long. In cross section, the trestle would be 30 feet deep, center to center of the truss chords and 20 feet wide, center to center of the trusses (figure 38). This provides an 18-foot-wide by 22-foot-high access way for the design vehicles from the shore to the berth. The gallery for the over-water segment of the concentrate conveyor would sit on top of the access trestle truss, offset to one side. This leaves space for a second conveyor to be added at some time in the future, if conditions ever warrant. The gallery would totally enclose the concentrate conveyor and include permanent dust suppression vacuum systems installed along the conveyor galleries with pick up points for a vacuum truck located at regular intervals.

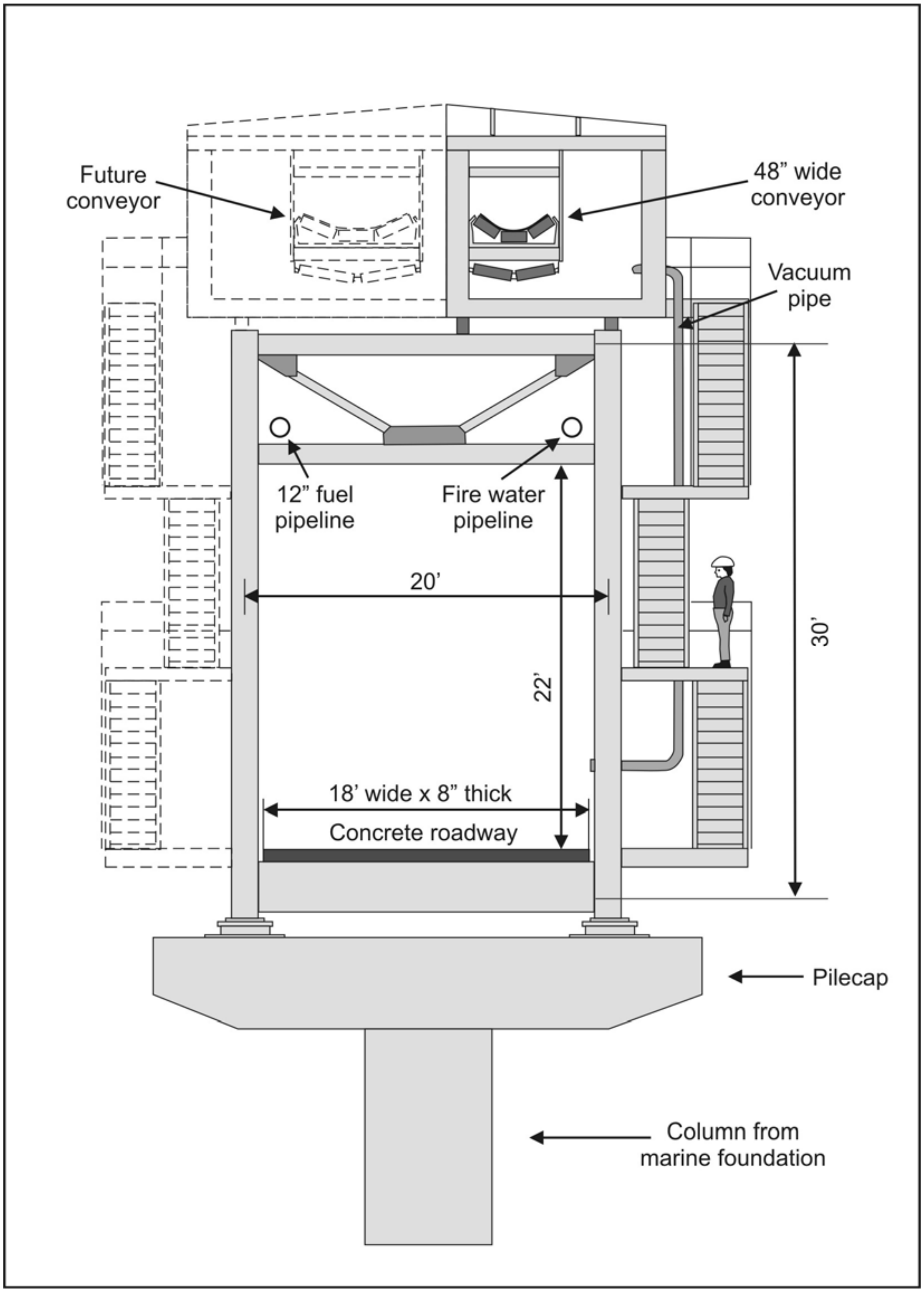

Figure 37. Access Trestle Section

An abutment on shore and marine foundations would support the trestle and dock. The abutment on shore would be formed by a combination of three interlocked sheetpile cells open on the shoreward end and backfilled with suitable material to provide a driving surface for the vehicles servicing the deep-water berth. Ten marine foundations would be required to support the trestle and dock. Four foundations would be provided for the trestle, five for the deep-sea dock, and one for a mooring dolphin The first two trestle foundations would be 74-foot-diameter sheetpile cells that would affect about 4,300 square feet (0.1 acre) each of seabottom. The other marine foundations would be either conical piers or monopile piers (see figure 21). As discussed earlier in Section 2, the feasibility cost estimate will be based on using conical piers. The area between the trestle abutment at the shoreline and the existing fill around the personnel accommodation complex and the new gasoline tank area would be filled with 70,000 yd^3 of select fill. This approximately 3.5-acre area would be covered to an elevation between +32 and +25 feet MLLW. Upon completion, the trestle assembly area would provide vehicle access to the trestle and dock.

Construction of the land-based facilities and trestle and the dredging and disposal of bottom material to create the channel and turning basin would cause minor and localized adverse impacts to vegetation and wetlands and minor and temporary adverse impacts to local air and water quality. It would also introduce additional noise, minor adverse impacts to local cultural and visual resources, and potentially significant impacts to marine mammal behavior or migration, and/or change other conditions related to access to resources currently harvested for subsistence near Portsite. After construction, annual bypass dredging and periodic maintenance dredging efforts would continue to cause minor and temporary impacts to local air and water quality. However, operation of the improved facilities would reduce the amount of ore concentrate released during the loading process, reduce fuel usage, exhaust emissions and marine-based noises from ore concentrate shipping activities and lower the overall risk of fuel spills in the Chukchi Sea by shifting some regional fuel delivery from barges to tankers and some lightering operations from floating sea-based operations in Kotzebue Sound to shore-based operations at the DMT.

4.3. Comparison of Final Alternatives

The final alternatives were compared and evaluated based on the four primary evaluation criteria, and the secondary criteria, economic, environmental, social, and engineering factors.

4.3.1. Economic Comparison of Final Alternatives

Cost estimates and benefit evaluations were developed for each of the final alternatives. These were developed to include costs for final design, construction (including mitigation), real estate, and operation and maintenance. A comparison of the NED costs and benefits (October 2004 price level 5-3/8 percent interest rate) is presented in table 27. Alternative 11 provides the maximum total benefits and the maximum net benefits. The table includes interest during construction to account for the opportunity cost incurred during the time after funds have been spent, but before benefits are realized. Interest during construction was calculated by matching the estimated construction expenditure flow with the interest the funds would have accumulated had they been deposited into an interest bearing account. The project schedule is based on it being authorized by Congress in the 2006 Water Resources Development Act. Final design work would be underway in FY 2007, with construction occurring during subsequent fiscal years. The construction periods for Alternatives 2, 9, and 11 were one year, 3 years, and 4 years, respectively. Alternative 2 could be in operation and producing benefits in the summer of 2009, Alternative 9 in 2010, and Alternative 11 in 2011.

Table 27. Comparison of Final Alternatives

	Alt1 No Action	Alt 2 Third Barge	Alt 9 Breakwater + Offshore Fuel Facility	Alt 11 Trestle + 53-foot Channel + Fuel Facility
Construction Cost:				
General Navigation	$0	$0	$71,899,252	$74,940,149
Local Service Facilities	$0	$24,023,100	$77,218,495	$155,452,622
subtotal	$0	$24,023,100	$149,117,747	$230,392,771
USCG Costs	$0	$0	$25,000	$27,000
Total Capital Costs	$0	$24,023,100	$149,142,747	$230,419,771
Interest During Construction	$0	$323,500	$9,806,017	$20,415,841
Total Investment Cost	$0	$24,346,600	$158,948,764	$250,835,612
Annualized Investment	$0	$1,411,631	$9,215,947	$14,543,603
OMRR&R	$0	$2,325,200	$4,249,467	$7,795,705
Average Annual Cost	$0	$3,736,831	$13,465,414	$22,339,308
Average Annual Benefits	$0	$2,553,500	$15,564,800	$26,898,700
Net Annual Benefits	$0	–$1,183,331	$2,099,386	$4,559,392
B/C Ratio	N/A	0.68 to 1.0	1.16 to 1.0	1.20 to 1.0

4.3.2. NED Benefits for Final Alternatives

The detailed benefit evaluation is contained in Appendix E, Economic Analysis. The following paragraphs provide a short summary. The analysis of benefits attributable to the implementation of alternatives used six general categories: (1) reduction in tug and barge costs, (2) reduction in port delay and queue costs, (3) vessel transit costs, (4) induced throughput, (5) fuel transportation savings, and (6) Portsite avoided costs (table 28).

Table 28. Summary of NED Benefits for Final Alternatives

Benefit Categories	Alt 2 Third Barge	Alt 9 – Breakwater +Offshore Fuel Facility	Alt 11 – Trestle + 53-foot Channel + Fuel Facility
Tug and Barge Costs	$0	$0	$10,788,300
Port Delay and Queue Costs	$1,208,100	$2,854,500	$3,333,200
Vessel Transit	–$232,900	$0	$0
Induced Tonnage	$1,707,900	$1,707,900	$1,707,900
Fuel Transportation Costs	$0	$11,002,400	$11,002,400
Other Avoided Costs	–$129,600	$0	$66,900
Average Annual Benefits	$2,553,500	$15,760,100	$26,898,700

4.3.2.1. Reduction in Tug and Barge Costs

Currently Foss uses four tugs to service the concentrate lightering barge operation during each summer season. For Alternatives 2 and 9 this operating procedure is expected to continue. For Alternative 11, the four existing Foss tugs would be replaced by two, 4,000 hp or 5,000 hp tractor tugs that would assist the concentrate bulk carriers and the fuel tankers to transit the deep-draft channel while incoming, berth at the new dock, and leave through the channel. The costs of operating the two tugs in the with-project future condition would be less than operating the four tugs in the without-project condition and thus is a potential project benefit. The detailed analysis of tug and barge costs is in Appendix E. The analysis determined that the net cost saving would be an average annual value of $10,788,300.

4.3.2.2. Reduction in Port Delay and Queue Costs

A simulation model was developed to reflect the operation of the Portsite marine facilities in both the without-project condition and under various with-project alternatives. This model is discussed in detail in appendix F, Portsite Dynamic Simulation Model. The model had two purposes: (1) to estimate the deep-draft vessel queue that will develop under the conditions analyzed that can be combined with vessel operating data to estimate delay reduction benefits, and (2) to estimate how much concentrate the without-project condition and each alternative can deliver based on a specific mine production target that can be combined with production and shipping costs to estimate induced tonnage benefits. The model makes a number of Monte Carlo decisions regarding determination of the shipping season, number and mix of vessels, docking parameters, and wind and wave data. The simulator is used to establish the annual tonnage shipped, the number of weather days, the amount of vessel delay to vessels in port, number and size of vessels, days in queue, and potential induced tonnage. The model was verified by checking to see if it could replicate weather delays to vessels in port known to have actually occurred during the shipping years of 1997 and 1998. There was a good correlation between the model's calculation for weather delays to vessels in port to the actual experience. Weather delays at the dock and any queuing effects were combined to prepare the estimates of port and queuing benefits of $1,208,100 for Alternative 2.

4.3.2.3. Reduction in Vessel Transit Costs

Some of the alternatives result in the shipping of more tons because of higher levels of efficiency. The increased tonnage is counted elsewhere as "induced tonnage." Higher tonnage levels require a larger number of vessels so the overall transit cost is actually higher with some alternative plans than it is in the without-project condition, thereby creating a "negative benefit." The analysis shows that Alternative 2 has a negative benefit of $232,900.

4.3.2.4. Induced Throughput Benefits

The NED benefit referred to as "induced" is derived from the increased production tonnage, which is possible because of the effects of an alternative. A detailed discussion of induced tonnage is provided in Appendix E. In this study, there is only one level of induced movement and one level of willingness to pay, because without a project there is neither an alternative mode nor an alternative port. With a project there is only one level of shipment that maximizes net income consistent with the shipper's management, investment, and operational strategy. The benefit attributable to induced tonnage is limited by the target throughput of 1,544,000 swt annually. The value of induced tonnage for all action alternatives was $1,707,900.

4.3.2.5. Fuel Transportation Savings

Portsite will be able to serve multiple beneficiaries by allowing for lower cost delivery of fuel to area villages. A detailed discussion of potential fuel savings is in Appendix E. In the without-project condition, some villages receive fuel by ocean barge delivery to a location 15 miles off Kotzebue, transfer in smaller lightering barges to a staging area at Kotzebue, and reshipment in river barges. Other villages rely on delivery through Nome by direct barge shipment from Puget Sound in Washington State or by river barge down the Yukon River. Improvements at Portsite would make possible fuel delivery from overseas by deep-sea tanker to Portsite and delivery to final destinations by the use of barge lightering combinations. A major transportation savings can be achieved due to the lower cost of fuel obtained from foreign sources and a net saving on the vessel transit costs.

The analysis considered the current fuel supply conditions and costs for six groups of villages and compared it with a likely future supply network that would depend on transshipment of fuel from Portsite. The village groups were (1) four villages on the Chukchi Sea, (2) four villages on Kotzebue Sound, (3) six villages on the Kobuk River, (4) 15 villages on Norton Sound or the Bering Sea, (5) 10 villages on the Lower Yukon River and Delta, and (6) seven villages on the Middle Yukon River. The current volume of fuel and mode of delivery were determined for each village and the costs estimated for the current ocean tug and barge operations, the coastal lightering fleet, and the inland lighters. The total amount of fuel for these villages in the without-project condition was determined to be about 33,000,000 U.S. gallons. Red Dog Mine, the DMTS, and Portsite would consume an additional 22,000,000 gallons at the 1,544,000-swt throughput level for concentrate.

The changes in fuel delivery modes and methods were then analyzed assuming direct delivery to Portsite, temporary storage in the existing Portsite fuel tanks, and transshipment to the village in northwestern arctic Alaska. The estimated costs of the new method of delivery to each of the villages under consideration were developed, including any increased cost of lightering that might be experienced for certain destinations. The fuel savings are estimated using Singapore as a purchasing point ($0.15 per U.S. gallon savings) and a deep-draft tanker for delivery to Portsite ($0.06 per U.S. gallon savings) while taking into account the changes in distribution costs (+ or -) for delivery to each village from Portsite. The total fuel transportation savings that could be achieved by direct supply to Portsite and transshipment to the identified villages totals an average annual value of $11,002,400 that could be realized by Alternatives 9 and 11.

4.3.2.6. Portsite Avoided Costs

Another benefit category to be analyzed was avoided costs that would not be part of the savings identified for the changes in the tug and barge operations. These would involve the savings that arise because reduced manpower and support costs would be required for crews that operate at Portsite. In the without-project condition, there are crew requirements reflecting the number of crewpersons on the tug and barge fleet and the support provided to them in the way of food and lodging at the Personnel Accommodations Complex. For Alternative 2, there would be an increase in the number of such personnel and their associated costs due to the addition of another tug and barge amounting to an estimated average annual value of $129,600. For Alternative 11, there would be a net average annual saving of $66,900 due to a reduction in the needed personnel to man two tractor tugs versus four conventional tugs and two concentrate lightering barges.

4.3.3. Environmental Effects of Alternatives

Each of the final alternatives was evaluated to determine their expected environmental impacts. A detailed analysis is contained in Section 4.0 of the draft EIS. Table 29 provides a summary of the significant environmental effects of each alternative by category. The following paragraphs discuss the most significant effects of each alternative.

4.3.3.1. Alternative 1 – No Action (Without-Project Condition)

The ore concentrate loading process and fuel consumption, delivery, storage, and distribution operations would remain unchanged. The major environmental effects associated with the without-project condition would continue. The current double handling of concentrate that contributes to fugitive dust over water would continue. The dust would continue to accumulate in Portsite sediments, but this is not anticipated to create a significant contamination problem. Existing beach processes would continue and make necessary the transport of beach buildup material to be mechanically transported past the shallow-water dock. This movement of 5,000 yd^3 of beach material annually would result in a small amount of local short-term turbidity down current. The existing sounds would continue as currently produced by Portsite operations. Tugs produce the strongest regularly produced sound likely to be detectable as far as 11 miles from Portsite. The arrival and departure of the bulk carriers may produce sounds detectable underwater as far as 20 miles from Portsite. The currently observed effect of belugas whales appearing to temporarily avoid areas of repeated tug and barge traffic would probably continue. There would be no short or long-term adverse or beneficial effects to environmental resources. Resident access to subsistence activities would remain the same as they are currently.

4.3.3.2. Alternative 2 – Third Barge

The addition of a third barge and one or two tugs would not cause a significant difference in environmental effects from the without-project condition. The total number of lightering barge trips would remain about the same with each of the three barges having fewer annual trips than the current two barge operation. The double handling of concentrate over water that contributes to fugitive dust would continue. The dust would continue to accumulate in Portsite sediments, but this is not expected to create a significant contamination problem. Existing beach processes would continue and make necessary the transport of beach buildup material to be mechanically transported past the shallow-water dock. This movement of 5,000 yd^3 of beach material annually would result in a small amount of local short-term turbidity down current. The existing sounds would continue as currently produced by Portsite operations. Tugs produce the strongest regularly produced sound likely to be detectable as far as 11 miles from Portsite. The arrival and departure of the bulk carriers may produce sounds detectable underwater as far as 20 miles from Portsite.

Adding a third barge and tugs to accompany it would not alter loading operations or associated fugitive dust emissions. Fuel consumption and associated exhaust emissions would increase by a small percentage due to the annual mobilization, operation and demobilization of the third barge, and the tugs needed to support it; additional barge conflicts at the loader, dock, and navigation lanes; and an incremental increase in hoteling near Portsite. Fuel delivery, storage, and distribution operations would remain unchanged. The additional barge and tugs would be new sources of sound and the increase in vessel traffic would result in a corresponding increase in spill potential related to their operation. However, the additional equipment would not make any appreciable difference in the strength of sounds in the water around Portsite or the distances those sounds could be heard and could be used to respond to larger spills should they occur. There would be no significant short or long-term adverse or beneficial effects to environmental resources. The currently observed effect of beluga whales appearing to temporarily avoid areas of repeated tug and barge traffic would probably continue. Resident access to subsistence activities would remain the same as in the without-project condition.

4.3.3.3. Alternative 9 – Breakwater and Offshore Tanker Facility

The construction of a breakwater to shelter the existing lightering barge loading operation would significantly reduce wave action at the loader. Barges and single ships would be able to dock and transfer fuel and freight at Portsite more safely and efficiently. The tanker facility could significantly reduce the cost of fuel at Portsite and northwest Alaska. The current double handling of concentrate over water would continue but smoother seas should result in a reduction in fugitive dust at the loader. The breakwater would appear as a low rock island 2,800 feet long and about 1,450 feet offshore. Small boats transiting the coast might have a small detour to pass the breakwater but it could serve as sheltered water during storms. The breakwater would have a minor slowing effect on currents and reduction of inshore waves that would interrupt sediment transport along the beach, accelerating accretion of coarse sands and gravels. Annual bypass operations would be required to move 26,000 yd^3. These operations would create a short-term increase in turbidity down current. Fifteen acre-feet of sediment moved might disturb 10 acres of sea bottom.

Breakwater construction would require 150 or more barge loads of rock shipped over a period of 3 years. This activity would not significantly increase current sound levels. Bypass dredging would create only short-term local sounds. There would be increased fuel barge and tanker activity, but there would be little change in the strength or frequency of sounds produced by Portsite operations. Tugs are the strongest regularly produced sound likely to be detectable as far as 11 miles from Portsite. The arrival and departure of the bulk carriers each year may produce sounds detectable underwater as far as 20 miles from Portsite.

Breakwater construction would likely kill the algae and slow moving invertebrates that currently inhabit its 13-acre footprint. The sea bottom would be replaced by rocky features rare in the Chukchi Sea. The breakwater would be colonized by invertebrates that prefer a rocky habitat, promoting a local increase in crab populations. The habitat, which would provide many nooks and crannies for juvenile and older fish to hide, would be attractive for Dolly Varden, coho, and Chinook salmon. Fuel line construction would disturb 10 acres of sea bottom, which would recolonize the following season.

Construction of the fuel line would require filling of about 0.5 acre of tundra wetland that is not likely to affect essential processes or values of the coastal lagoon complex. The currently observed effect of belugas appearing to temporarily avoid areas of repeated tug and barge traffic would probably continue. Breakwater construction also might temporarily divert gray whales from their migratory path. Native hunters might use the breakwater as a vantage point to hunt ringed and bearded seals. Construction activities would not increase levels of lead or other contaminants or fugitive dist and do not represent a disproportionate effect.

The ore concentrate loading process would remain unchanged but the loss of ore concentrate at the loading dock may be slightly reduced by improved loading conditions. Construction of a breakwater and offshore tanker facility would bury existing biological resources and cause minor and localized adverse impacts to water and air quality but would create new, rock-based habitat that does not currently exist near Portsite. After construction, annual bypass and periodic maintenance dredging efforts would continue to cause minor and temporary adverse impacts to local water and air quality, but operation of the new facilities would lower the overall risk of fuel spills in the region by shifting some regional fuel delivery from barges to tankers and some lightering operations from floating sea-based operations in Kotzebue Sound to shore-based operations at the DMT. Locally, the risk of fuel spills would increase due to the increased volume of fuel transferred through the DMT system and the greater complexity of system operation and maintenance procedures. The breakwater would also present a new physical presence offshore that could impact local visual resources and may impact marine mammal behavior or migration, and/or change other conditions related to access to resources currently harvested for subsistence near Portsite.

4.3.3.4. Alternative 11 – Trestle, Channel, and Tanker Facility

The construction of a trestle and deep draft dock to provide support for an enclosed concentrate conveyor, vehicle access and a fuel facility, and a dredged channel to provide access for ocean going bulk carriers and fuel tankers would significantly improve the capability of Portsite to process base metal concentrate exports and fuel imports with transshipment to northwest arctic villages. Concentrate transportation costs would be reduced and fuel costs could be reduced significantly. The alternative would also incidentally improve the ability of Portsite to process occasional bulk or container cargo. The direct loading to bulk carriers would halve the current double handling of concentrate over water. The improved shiploaders, enclosed conveyors, and vacuum system would substantially reduce the fugitive dust and potential contaminants at Portsite. The new trestle and dock would extend about 1,900 feet into the Chukchi Sea, about twice as far as the current lightering barge dock. The lightering barges and their escort tugs would no longer be needed–replaced by a pair of tractor tugs to berth and deberth the bulk carriers and tankers. The total number of tug transits at Portsite would be reduced substantially. There would be increased fuel barge activity.

Annual bypass operations for beach sediments accumulating north of Portsite would continue with its small amount of short-term local turbidity. The construction of the channel, turning basin, and berthing area would create a seafloor depression about 18,600 feet long and up to 34 feet deep (39 feet with advanced maintenance). About 6.3 million yd^3 of material would be excavated initially to provide a design depth of –53 feet MLLW. Anticipated advanced maintenance would amount to an additional 1.9 million yd^3, with periodic maintenance dredging during project life (5, 17, 33, and 49 years) totaling another approximately 1.5 million yd^3. Excavation and disposal would bury or substantially disturb benthic algae populations on 7,000 acres of sea bottom, with another potential 500 acres affected by suspended sediments down current from dredged areas. Turbidity from suspended sediments would be visible at the site of activity and for up to several miles down current.

Construction of the land-based facilities and trestle and the dredging and disposal of bottom material to create the channel and turning basin would cause minor and localized adverse impacts to vegetation and wetlands and minor and temporary adverse impacts to local air and water quality. It would also introduce additional noise, minor adverse impacts to local cultural and visual resources, and potentially significant impacts to marine mammal behavior or migration, and/or change other conditions related to access to resources currently harvested for subsistence near Portsite.

After construction, annual bypass dredging and periodic maintenance dredging efforts would continue to cause minor and temporary impacts to local air and water quality. However, operation of the improved facilities would reduce the amount of ore concentrate released during the loading process, reduce fuel usage, exhaust emissions and marine-based noises from ore concentrate shipping activities and lower the overall risk of fuel spills in the Chukchi Sea by shifting some regional fuel delivery from barges to tankers and some lightering operations from floating sea-based operations in Kotzebue Sound to shore-based operations at the DMT.

Deposition of dredged material at the disposal site would raise the sea bottom up to 5 feet over much of the 5,600-acre site. Some invertebrates would survive dredging and disposal, but most would be killed. Regional populations numbers or distribution is not expected to be affected. Reestablishment of invertebrates to pre-dredging levels in the channel, turning basin, berthing area, and disposal site is expected to be rapid.

Table 29. Summary of Significant Environmental Effects

	Alt 1 – No Action	Alt 2 – Third Barge	Alt 9 – Breakwater + Offshore Fuel Facility	Alt 11 – Trestle-53' Channel + Fuel Facility
Local Communities	No change	No change	Potential substantial reduction in fuel costs	Potential substantial reduction in fuel costs
Infrastructure & Transportation	No change	No change; more barges would make fewer trips each	Minor effect on small boats transiting along shore and could be shelter during storms. Increased fuel barge activity and occasional tanker visits.	Minor effect on small boats transiting along shore. Increased generating capacity required. Concentrate barges and tugs no longer necessary. Pair of tractor tugs required for berthing and deberthing bulk carriers and tankers. Increased fuel barge activity.
Regional Planning Consistency	No change	Third barge requires additional mooring buoy (modification of existing Corps' permit) consistent with C2M standards.	Consistent with C2M standards.	Consistent with C2M standards.
Visual Resources	No change. Existing facilities visible along coast up to 10 miles.	Addition of one barge and one or two tugs during shipping season.	Addition of permanent low rubblemound offshore from Portsite and occasional tanker moored offshore.	New trestle/dock extending about twice as far into ocean will be visible farther along the coast.
Air Quality	No change in loading or double handling of concentrate that produces fugitive dust.	No change in loading or double handling of concentrate that produces fugitive dust.	Reduce wave action for loading which may result in more reduction in fugitive dist.	Loading directly to bulk carriers eliminates double handling and helps handling that produces fugitive dust. Improved shiploaders, enclosed conveyors, and improved vacuum system would substantially reduce fugitive dust. Increased generating capacity required, resulting in emmissions.
Beach Processes	Existing beach processes continue. Mechanical transport of material past shallow-water dock would continue.	Existing beach processes continue. Mechanical transport of material past shallow-water dock would continue.	Breakwater would reduce inshore waves and interrupt sediment transport. Material would be dredged periodically and deposited down current.	Annual bypass dredging would continue the flow of beach material to the south of Portsite.
Bathymetry	Minor scour of soft sediments at barge loader by tug boats.	Minor scour of soft sediments at barge loader by tug boats.	Breakwater would add 2,800 foot long low rock island about 1,450 feet offshore. Breakwater would accelerate accretion of coarse sands and gravels north of dock that would be dredged and deposited on beach south of Portsite. Minor scour of soft sediments at barge loader by tugs as their powerups would continue.	Channel turning basin and berth create seafloor depression up to 34 feet deep. Deposition of dredged material at disposal site would raise sea bottom up to 5 ft over the 5,600 acre area.
Currents	No change.	No change.	Breakwater would have minor slowing effect on currents downstream of structure.	Pilings would create minor eddies in current that could serve as fish attractant.

	Alt 1 – No Action	Alt 2 – Third Barge	Alt 9 – Breakwater + Offshore Fuel Facility	Alt 11 – Trestle-53' Channel + Fuel Facility
Ice	No change.	No change.	Breakwater would have little effect on ice in shore-fast zone. When in actively moving ice zone, ice would pile up and overtop breakwater.	Pilings would have little effect on ice in shore-fast zone. When in actively moving ice zone, pilings would break up ice forced against them.
Sediments	Small amounts of fugitive dust would continue to accumulate in Portsite sediments. Existing beach material bypass (5,000 yd^3) would create minor sediments.	Small amounts of fugitive dust would continue to accumulate in Portsite sediments. Existing beach material bypass (5,000 yd^3) would create minor sediments.	Bypass operations to remove accumulated sediments would move more material (26,000 yd^3) and create more sediment than under existing conditions.	Improved loading and conveyors would greatly reduce fugitive dust in sediment. Dredging and disposal of materials would result in temporary substantial increase in suspended sediments.
Marine Water Quality	Existing mechanical movement of beach material (5,000 yd^3) would continue with small amounts of local short-term turbidity.	Existing mechanical movement of beach material (5,000 yd^3) would continue with small amounts of local short-term turbidity.	Annual bypass dredging (26,000 yd^3) would provide small amount of local short-term turbidity.	Turbidity from suspended sediments produced by dredging and disposal of dredged material would be visible at site of activity and for up to several miles down current. Annual bypass dredging (26,000 yd^3) would provide small amount of local short-term turbidity.
Fuel Spills	No change	No change	Increased fuel volumes transferred through DMT facilities and increased length and complexity of the system would increase the risk of fuel spills.	The risk of fuel spills from lightering barges would be eliminated. Increased fuel volumes transferred through DMT facilities and increased length and complexity of the system would increase the risk of fuel spills. These two impacts would offset. There would be no significant net change in local risk of fuel spills
Wetlands	No new effect.	No new effect.	No new effect. (Assumes material for breakwater comes from existing quarry.)	Construction and operation of alternative requires fill of 2.5 acres of wet tundra and vernal lagoon habitat that is not likely to affect essential processes or values of coastal lagoon complex.
Noise	Existing sounds would continue as they are now. Tugs are strongest regularly produced noise likely to be detectable as far as 11 miles from Portsite. Arrival and departure of 21 bulk carriers each year may produce sounds detectable underwater up to about 20 miles from Portsite.	Addition of third barge would not make any appreciable difference in strengths of sounds or distances they could be heard currently in air and water.	Breakwater construction would require 150 or more barge loads of rock to be shipped to Portsite over 3 years. This activity would not significantly increase current sound levels. Bypass dredging would create only short-term local sounds. There would be little change in strength or frequency of sounds produced by Portsite operations.	Sounds from pile driving, trestle/dock erection, and dredging would be detectable a mile in air and 12 miles in water. Tugs towing barges with dredged material might be detectable 8 miles offshore in air and 13.5 miles underwater. Loading vessels at the new dock would be much quieter than the old system due to substantial reduced tug activity.
Terrestrial Vegetation	No effect.	No effect.	Requires fill of 0.5 acres of tundra wetland.	Requires fill of 3.5 acres including tundra, beach berm, wetland, and vernal lagoon habitat.

	Alt 1 – No Action	**Alt 2 – Third Barge**	**Alt 9 – Breakwater + Offshore Fuel Facility**	**Alt 11 – Trestle-53' Channel + Fuel Facility**
Marine Vegetation and Algae	Minor effect on algae on bottom due to movement of (5,000 yd^3) of material annually.	Minor effect on algae on bottom due to movement of (5,000 yd^3) of material annually.	Bypass dredging of (26,000 yd^3) annually would affect algae at bottom of accretion zone. Fifteen acre feet of sediment might disturb 10 acres of bottom. Excavation for fuel pipeline would disturb 10 acres of sea bottom for a season.	Excavation and disposal would bury or substantially disturb benthic algae populations on about 7,000 acres of sea bottom. Another 500 acres might be affected by suspended sediments down current from dredged acres. Suspended sediments would increase turbidity in immediate activity area and down current.
Marine Invertebrates	No change.	No change.	Construction would kill most of slow-moving invertebrates that currently inhabit 13 acre foot-print. Breakwater would be colonized by invertebrates that prefer rocky habitat, promoting a local increase in number of crabs.	Some invertebrates would survive dredging but most would be killed in dredging and disposal area. Regional population numbers or distribution would not be affected. Reestablishment of invertebrates to predredging levels in channel, turning basin, and disposal site would be rapid.
Fish	No significant impact.	No significant impact.	Breakwater would replace about 13 acres of sea bottom with rocky features in the Chukchi Sea.	Pilings could become small, locally important additions to marine habitat providing cover and feeding habitat for a variety of fish. Noise, activity, and turbidity would temporarily displace fish from construction areas.
Beluga Whales	No change from present. Belugas appear to temporarily avoid areas of repeated tug and barge traffic.	No change from present. Belugas appear to temporarily avoid areas of repeated tug and barge traffic.	No change from present. Belugas appear to temporarily avoid areas of repeated tug and barge traffic.	Alternative would produce far less sound energy then existing lightering barge system, which might reduce effect on beluga whales.
Gray Whales	No direct effect from current operations.	No direct effect from current operations.	Construction could displace gray whales from migratory path.	Construction could displace gray whales from migratory path.
Ringed Seal	No current effect.	No current effect.	No current effect. Hunters might use breakwater as vantage point to hunt seals.	No current effect.
Bearded Seal	No current effect.	No current effect.	No current effect. Hunters might use breakwater as vantage point to hunt seals.	No current effect.
Small Mammals	No impacts.	No impacts.	Displacement of small mammals would not result in substantial adverse effects.	Displacement of small mammals would not result in substantial adverse effects.
Threatened and Endangered Species	No effects.	No effects.	No effects.	Unlikely to result in adverse impact.
Essential Fish Habitat	No effects.	No effects.	Negligible impact.	Negligible impact.
Cultural Resources	No effects.	No effects.	No effects.	Potential to affect two historic properties located on south Portsite lagoon.

	Alt 1 – No Action	**Alt 2 – Third Barge**	**Alt 9 – Breakwater + Offshore Fuel Facility**	**Alt 11 – Trestle-53' Channel + Fuel Facility**
Unique Visual and Cultural Associations	No change.	No change.	Visible breakwater is a slight change.	New trestle/dock would be minor change to visual resources.
Mining Effects	No change.	No change.	Reduced wave action would reduce potential for concentrate loss during loading.	Improved loading system would reduce level of contaminants at Portsite.
Lead Levels	No change.	No change.	Construction activities would not increase levels of lead or other contaminants or fugitive dust and do not represent a disproportionate effect.	New conveyor systems would reduce amount of fugitive dust.
Access to Subsistence	No change.	No change.	No significant change.	No significant change.
Effect on Animals	No significant impact.	No significant impact.	No significant impact.	Effect of alternative on beluga whales and other sea mammals is uncertain.
Community Effect	No change.	No change.	Breakwater allows barges and other ships to dock and transfer fuel and freight at Portsite more safely and efficiently.	Alternative could significantly reduce cost of fuel and freight transportation.

Pilings would create minor eddies in the current that would serve as an attractant for fish. They could become small, locally important additions to the marine habitat providing cover and feeding habitat for a number of fish. Sounds from pile driving, trestle and dock erection, and dredging would be detectable a mile in air and up to 12 miles underwater. The tugs towing barges with dredged material or the hopper dredges might be detectable 8 miles offshore in the air and 14 miles underwater. There would be little change in strength or frequency of sounds produced by the current Portsite lightering barge operations during construction. The sounds produced by the new trestle and deep draft dock loading operations would be much quieter than the lightering barge operation, with far less sound energy because of the generally reduced tug activity.

Construction and operation of this alternative would require the fill of 1.5 acres of tundra wetland and vernal lagoon habitat that is not likely to affect essential processes or values of the coastal lagoon complex. Noise, activity, and turbidity would temporarily displace fish from construction areas, but the substantially quieter operations in the future might reduce whatever impact the existing lightering barge operation may have on beluga whale migration. There could be project impacts on two historic properties along the south Portsite lagoon.

4.3.4. Alternative Effects on Subsistence

Each of the final alternatives was evaluated to determine their expected impact on subsistence activities of the Alaska Natives. A detailed analysis of subsistence impacts is provided in Section 4.3 of the draft EIS. Table 30 provides a summary of that analysis identifying anticipated significant effects of each alternative by category. The following paragraphs discuss the most significant impacts of each alternative.

4.3.4.1. Alternative 1 – No Action (Without-Project Condition)

The existing lightering barge loading facilities at Portsite may occasionally impede or divert boat traffic along the coast or vehicle travel along the beach. The small amount of concentrate loses at Portsite and fugitive dust are unlikely to increase any contaminant to threshold levels of concern or cause any detectable increase of lead or other heavy metals in subsistence resources nearby Portsite. The noise and activity of current lightering barge loading and shiploading operations may affect movements of eastern Chukchi Sea stock beluga whales by making them migrate farther offshore than prior to construction of Portsite. There are no apparent impacts to other subsistence resources.

4.3.4.2. Alternative 2 – Third Barge

The addition of a third barge and one or two more tugs would not cause a significant change in Portsite’s impact on subsistence resources. The existing lightering barge loading facilities at Portsite may occasionally impede or divert boat traffic along the coast or vehicle travel along the beach. The small amount of concentrate losses at Portsite and fugitive dust are unlikely to increase any contaminant to threshold levels of concern or cause any detectable increase of lead or other heavy metals in subsistence resources nearby Portsite. The noise and activity of current lightering barge loading and shiploading operations may affect movements of eastern Chukchi Sea stock beluga whales by making them migrate farther offshore than prior to construction of Portsite. There are no apparent impacts to other subsistence resources.

4.3.4.3. Alternative 9 – Breakwater and Tanker Facility

Construction of a breakwater and tanker facility would not cause a significant change in Portsite's impact on subsistence resources. The breakwater might require a slightly longer detour for boats or snow machines traveling the coast or vehicles traveling along the beach. The breakwater would somewhat lessen the potential for ore concentrates to be lost during loading or from barge damage. The small amount of concentrate loses at Portsite and fugitive dust are unlikely to increase any contaminant to threshold levels of concern or cause any detectable increase of lead or other heavy metals in subsistence resources nearby Portsite. The noise and activity of current lightering barge loading and shiploading operations may affect movements of eastern Chukchi Sea stock beluga whales by making them migrate farther offshore than prior to construction of Portsite. Construction of the fuel facility might lessen the chance for harvest of one beluga whale. Construction of the breakwater might make a small number of bearded seals less available for harvest, but the breakwater, when in place, might serve Native hunters as a lookout site to be better able to spot bearded and ringed seals. There are no apparent impacts to other subsistence resources.

4.3.4.4. Alternative 11 – Trestle, Channel, and Tanker Facility

Construction of a trestle, deep-draft dock, dredged channel, and dredged material disposal site would not cause a significant adverse change in Portsite's impact on subsistence resources. The direct loading of ore concentrate onto ocean going bulk carriers would significantly reduce the potential for loss of contaminants to the sea bottom sediments and the amount of fugitive dust. The reduced amount of concentrate loses at Portsite and fugitive dust are unlikely to increase any contaminant to threshold levels of concern or cause any detectable increase of lead or other heavy metals in subsistence resources nearby Portsite. The noise and activity of current lightering barge loading and shiploading operations would be greatly reduced by the direct loading of bulk carriers. This could lessen the perceived impact on beluga whale migration caused by Portsite. Construction activities over 3 years could lessen the chance for harvest of one or two beluga whales. Maintenance operations over 50 years could lessen the chance for harvest of one to three beluga whales. One or more polar bears attracted to winter construction activities could be harvested by Native hunters to protect construction workers. There are no apparent impacts to other subsistence resources.

Table 30. Summary of Impacts on Subsistence

	Alt 1 No Action	Alt 2 Third Barge	Alt 9 Breakwater + Offshore Fuel Facility	Alt 11 Trestle-53' Channel + Fuel Facility
Access	Existing facilities may occasionally impede or divert boat traffic along coast or vehicle travel along beach	No change.	Breakwater might require minor detour for boats or snow machines.	Trestle might require minor detour for boats or snow machines.
Contaminants & Water Quality	Concentrate loses at Portsite unlikely to increase any contaminant to threshold levels of concern or cause any detectable increase of lead or other heavy metals in subsistence resources.	No change.	Breakwater would lessen potential for ore concentrates to be lost during loading or from barge damage.	Direct ore concentrate handling would allow more efficient loading directly into ships holds reducing potential contaminants and fugitive dust.
Beluga Whales	Loading operations may affect movements of eastern Chukchi Sea stock belugas, forcing them farther offshore.	Loading operations may affect movements of eastern Chukchi Sea stock belugas, forcing them farther offshore.	Construction could lessen chance for harvest of beluga.	Construction could lessen chance for harvest of belugas. Maintenance operations could lessen chance for harvest of belugas over 50 year project economic life.
Bowhead Whales	Existence of Loading facilities may affect movements of bowheads and their availability to hunters.	Existence of Loading facilities may affect movements of bowheads and their availability to hunters.	Construction could lessen chance for harvest of bowheads.	Construction could lessen chance for harvest of bowheads. Maintenance operations could lessen chance for harvest of bowheads over 50 year project economic life.
Grey Whales	No apparent effect.	No apparent effect.	No apparent effect.	No apparent effect.
Bearded Seals	No apparent effect.	No apparent effect.	Breakwater might make small number of bearded seals less available for harvest.	Trestle/dock might make small number of bearded seals less available for harvest.
Ringed Seal	No apparent effect.	No apparent effect.	Unlikely to affect harvest.	Unlikely to affect harvest.
Spotted Seal	No apparent effect.	No apparent effect.	No apparent effect.	No apparent effect.
Polar Bear	No effect.	No effect.	No effect.	Winter construction could result in harvest of one or more polar bears that approach construction areas.

4.3.5. Mitigation Measures for Detailed Alternatives

The following paragraphs discuss the mitigation measures, previously listed in table 22, that are considered for implementation as part of each of the detailed alternatives. Concerns raised during scoping, coordination with agencies and other stakeholders, and analysis of potential impacts of project construction, operation, and maintenance identified these measures as ones that might avoid or reduce adverse project impacts. A more complete description of each is contained in Section 2.4 of the draft EIS. Mitigation measures can be added to or removed from any alternative after public review of the draft IFR and EIS. Table

31 provides a summary of the mitigation measures included in the final alternatives. The overall cost of mitigation by alternative is listed in table 32.

Working on planning regarding a possible road from Noatak to the DMTS road can be accomplished by the State of Alaska and the local communities outside this study. If such a road were built, a small amount of cargo and fuel would probably be offloaded at DMT and trucked to Noatak.

Alternative 1, the No-Action Plan, has no other mitigation measures. Alternative 2, the Third Barge, has very minimal impacts and likewise no other mitigation measures. A number of mitigation measures would be included in both Alternatives 9 and 11, such as construction windows, monitoring of mammals and dredge plumes, regional fuel planning, by-pass dredging, cultural surveys, awareness training, and local hire. Mitigation unique to Alternative 9 would include the fuel pipeline tunnel and the hard-bottom habitat monitoring. Measures unique to Alternative 9 include the design criteria for the trestle/dock regarding aerial wires, paint colors, and dust containment. Total estimated first costs for mitigation measures for Alternatives 9 and 11 are, respectively, $5,842,000 and $1,631,000. In addition, both alternatives would provide for the annual by-pass dredging of 26,000 cy at a cost of $325,000. In general, the mitigation measures are attributable to the construction and operation of the local service facilities. However, some can apply to both, such as M1, M9, M11, and M14.

Table 31. Mitigation Measures in Detailed Alternatives

	Alternative	Alt. 1	Alt. 2	Alt.9	Alt. 11
M1	Construction timing windows	N/A	NO	YES	YES
M2	Marine mammal monitoring	NO	NO	YES	YES
M4	Minimize areial wires	NO	NO	NO	YES
M5	Restrict lighting on structures	NO	NO	NO	YES
M6	Bird-friendly paint color	NO	NO	NO	YES
M8	Cultural resources survey	NO	NO	YES	YES
M9	Cultural awareness training	NO	NO	YES	YES
M11	Disposal plume monitoring	N/A	N/A	YES	YES
M13	Annual By-pass dredging	NO	NO	YES	YES
M14	Work on Red Dog-Noatk road	YES	YES	YES	YES
M15	Regional fuel distributors coord	N/A	N/A	YES	YES
M16	Hire local workers	NO	NO	YES	YES
M17	Directionally drilled fuel tunnel	N/A	N/A	YES	N/A
M18	Hard Bottom Monitoring	N/A	N/A	YES	N/A
M19	Catch and report bird strikes	N/A	N/A	N/A	MAYBE
M20	Radar monitor of birds	N/A	N/A	N/A	MAYBE

Table 32. Mitigation Cost by Detailed Alternative

	Alternative	Alternative Mitigation Cost
A1	No Action	None
A2	Third Barge	None
A9	Breakwater & Offshore Fuel Facility	$5,842,000 1/
A11	Trestle, Channel, and Fuel Facility	$1,631,000 1/ 2/

1/ Also an annual $325,000 required for By-Pass Dredging of 26,000 cy.

2/ Costs for measures M19 and M20 not included.

4.3.6. Comparison of Alternatives

The four alternatives selected for detailed analysis have been evaluated. Table 31 provides a comparison among the alternatives for use in identifying plans and selecting a tentatively recommended plan. Each of the following paragraphs compares the alternatives in regard to planning objectives and planning constraints, evaluation criteria, systems of accounts, and technical criteria.

4.3.6.1. Planning Objectives and Planning Constraints

Alternative 1 (No-Action Plan) does not change the existing conditions, and therefore, does not address the planning objectives. Alternative 2 (Third Barge) would not meet the planning objectives, but also increase transportation coasts for moving the same volume of concentrate. Both Alternative 9 (Breakwater and Tanker Facility) and Alternative 11 (Trestle-Channel-Tanker Facility) would meet the planning objectives for both concentrate and fuel movement while accommodating or minimizing impact to the planning constraints.

4.3.6.2. Evaluation Criteria

Alternative 1 is used as a base to measure the outputs and impacts the other alternatives. Alternative 2 fails by meeting only one criterion, completeness. It does have all the costs included to ensure the same volume of concentrate can be moved at a higher cost. Alternative 9 is complete, effective (addresses both concentrate and fuel movement), efficient with annual net benefits of $2.1 million, and potentially acceptable. Alternative 11 is complete, effective (addresses both concentrate and fuel movement), efficient with annual net benefits of about $4.6 million, and potentially acceptable.

4.3.6.3. System of Accounts

National Economic Development Account. Alternative 2 does not provide any significant improvement over the without-project condition. Alternative 9 provides the maximum improvement practical if a concentrate lightering barge based system is to be retained while also considering measures to improve fuel movement. Alternative 11 most effectively addresses improvements for both concentrate and fuel movement.

Environmental Quality. Alternative 2 provides no significant change in the EQ account from the without-project condition. With three barges there might be a slight increase in the risk of oil spills or marine accidents due to more vessels operating in the same area. Alternative 9 would provide similar improvements for concentrate movement, but the addition of the tanker facility might reduce the risk of oil spills with the attendant environmental problems.

Alternative 11 would provide a significant reduction in the potential for a concentrate spill and fugitive dust. It would also handle the transfer of fuel in a safer manner than using the open roadstead tanker offloading facilities. Alternatives 9 and 11 both would have short-term adverse environmental impacts due to construction activities, but with proper mitigation, no long-term significant adverse impact is anticipated.

Regional Development. Alternative 2 would make no contribution to regional development, costing more than current operations. Alternative 9 adds a least-cost, stand alone tanker facility to the best lightering barge option to provide a substantial increase for regional development in reduced fuel/transportation costs for Portsite and for northwestern Alaska villages. Alternative 11 adds a least-cost fuel facility to a concentrate option to provide for significantly improved concentrate and fuel movement at current throughput levels: It can also obtain some incidental benefits (not included in economic analysis) for better moving bulk and container cargo into Portsite.

Other Social Effects. The most important social effect resulting from a plan in this area is its effect on Alaska Natives' ability to continue to hunt, fish, and gather subsistence resources. None of the alternatives are anticipated to have significant impacts on subsistence. Alternative 11 may have the greatest impact, but this is uncertain. The worst case analysis indicated that its implementation would be expected to result in a chance for Natives to harvest two to five fewer beluga whales over the 50-year economic analysis period. The significant reduction in overall noise levels provided by Alternative 11 might even improve the whale harvesting opportunities over the without-project condition.

4.3.6.4. Technical Criteria

All the alternatives were developed with the technical criteria in mind. All meet appropriate criteria to the extent practicable. During Preconstruction Engineering and Design (PED), the criteria will be further refined to ensure a properly designed project will be produced that will provide the estimated benefits at or below the costs identified.

4.3.6.5. Corps Environmental Operating Principles

In order to address the Corps' EOPs and incorporate them into any potential navigation improvement project at the DMT, the Corps evaluated the direct, indirect, and cumulative impacts to the environment and affected populations and the potential to incorporate a variety of mitigation measures to eliminate, reduce, and compensate for adverse environmental and social effects of the project. Additionally, the potential for project construction and operation to effect local, regional, national and, to a limited extent, worldwide resource commitment and consumption were also evaluated. The evaluations utilize a wide variety of scientific, social, and economic data, and knowledge gleaned from local, regional, and national sources. The evaluations related to the integration of the EOPs into the project planning documents have been performed for each alternative that is considered in detail and are integrated into discussions of individual subjects presented throughout the draft EIS. Both scientific and traditional knowledge were used to document compliance with regulations and policies and to attempt to balance known and potential adverse impacts with beneficial environmental and economic effects and anticipated improvements in operational safety and efficiency. The draft EIS also presents information related to other potential local and regional development opportunities and attempts to identify areas where individual or combined project components may present synergistic or conflicting features in an attempt to consider opportunities to facilitate future development in a manner that supports and reinforces the viability and maintenance of healthy and diverse natural systems.

4.4. Designation of Plans

Based on the previously discussed information, the Non-Structural Plan, the NED Plan, and the Technically Recommended Plan will be designated in the following paragraphs.

4.4.1. Nonstructural Plan

A Non-Structural Plan for a navigation project is defined as an alternative that does not rely on major construction of new or improved general navigation features or major improvements in marine terminals by potential project sponsors. It often will rely on such measures as traffic control, use of tides, berthing adjustments, elimination of shoreside bottlenecks, etc. None of these measures were considered appropriate for consideration at Portsite. However, Alternative 2 presents a measure that is essentially non-structural. It does not involve the construction of new general navigation features or major changes in the existing shoreside facilities. It would involve the construction and/or lease of an additional concentrate lightering barge and an additional tug to move base metal concentrate from Portsite to Panamax or Handysize bulk carriers offshore. Therefore, Alternative 2 is designated the Non-Structural Plan."

4.4.2. National Economic Development Plan

The National Economic Development Plan is defined as that alternative that reasonably provides the highest average annual net NED benefits. As demonstrated in table 31, Alternative 11 with the 53-foot-deep design channel has the greatest average annual net benefits for the detailed alternatives and is designated the NED Plan. The Locally Preferred Plan, if any, is determined by the local, non-federal study sponsor. Since the sponsor supports the NED Plan, there is no separately designated Locally Preferred Plan in this report.

4.5. Rationale for Selection of the Tentatively Recommended Plan

The Tentatively Recommended Plan is Alternative 11, the Trestle, 53-foot Dredged Channel, and Fuel Facility Plan. It emerges as the most effective plan when all the planning objectives, planning constraints, and evaluation criteria are considered. It is the NED Plan. The local sponsor also prefers this plan. The adverse environmental impacts expected to occur as a result of implementing this plan are relatively minor. Implementation of the plan is not expected to have a measurable impact on the ability of local residents to maintain their current subsistence activities. The impact of the project on their ability to harvest beluga whales is uncertain. Over the 50-year analysis period, local Alaska Natives may have a reduced opportunity to harvest two to five beluga whales. Economic benefits from the plan will be widespread as the plan can be a step in lowering fuel prices to residents throughout northwestern Alaska.

Table 33. Detailed Alternative Comparison

	Alt 1 No Action	Alt 2 Third Barge	Alt 9 Breakwater + Offshore Fuel Facility	Alt 11 Trestle-53' Channel + Fuel Facility
Total Implementation Cost (2004 PL)	$0	$24,023,100	$149,142,747	$230,419,771
Total Investment Cost (including IDC)	$0	$24,346,600	$158,948,764	$250,835,612
Annualized Investment Cost (5-3/8%)	$0	$1,411,631	$9,215,947	$14,543, 603
Annual OMRR&R Cost	$0	$2,325,200	$4,249,467	$7,795,705
Average Annual Cost	$0	$3,736,831	$13,465,414	$22,339,308
Average Annual Benefits	$0	$2,553,500	$15,564,800	$26,898,700
Annual Net Benefits	$0	–$1,183,331	$2,099,386	$4,559,392
Benefit-to Cost Ratio	N/A	0.68 to 1.0	1.16 to 1.0	1.20 to 1.0
Planning Objectives				
Promote National Economy	No	No	Yes	Yes
Increase Portsite Efficiency	No Chng.	Less Efficient	Major For Fuel	Major Incr. (Fuel & Cnctr.)
Improve Portsite Capability	No Chng.	Minor Increase	Major For Fuel	Major Incr. (Fuel & Cnctr.)
Improve Portsite Safety	No Chng.	No Chng.	Yes	Yes
Improve Delivery of Goods/Services	No Chng.	No Chng.	Minor Improvement	Yes
Reduce Risk of Spills	No Chng.	Minor Increase	Yes	Yes
Reduce Total Marine Transits	No Chng.	Increase	Decrease	Decrease
Reduce Environmental Risks	No Chng.	Increase	Minor Increase	–
Protect Arctic Environment	No Chng.	No Chng.	No Chng.	No Chng.
Reduce Future Resource Costs	No Chng.	Increase	Yes For Fuel	Yes (Fuel & Cnctr.)
Support Future Development	No Chng.	No Chng.	No Chng.	Space For 2nd Cnvy.
Reduce Regional Costs	No Chng.	No Chng.	Yes For Fuel	Yes For Fuel
Planning Constraints				
Avoid Interrupting Lightering	Yes	Yes	Yes	Yes
Accommodate Arctic Conditions	Yes	Yes	Yes	Yes
Retain Transportation Mode	Yes	Yes	Yes	Yes
Accommodate Panamax & Handy	Yes	Yes	Yes	Yes
Avoid Impact to Cape Krusenstern N.M.	Yes	Yes	Yes	Yes
Avoid Impact to NANA lands	Yes	Yes	Yes	Yes
Avoid Impact to NWAB lands	Yes	Yes	Yes	Yes
Avoid Impact to village lands	Yes	Yes	Yes	Yes

	Alt 1 No Action	Alt 2 Third Barge	Alt 9 Breakwater + Offshore Fuel Facility	Alt 11 Trestle-53' Channel + Fuel Facility
Minimize Impact to Fish	Yes	Yes	Yes	Yes
Minimize Impact to Wildlife	Yes	Yes	Yes	Minor Impact
Not Adversely Affect Subsistence	Minor	Minor	Minor	Minor Impact
Meet AIDEA Investment Criteria				
Keep Costs Within Financing				

Evaluation Criteria:				
Completeness	Yes	Yes	Yes	Yes
Effectiveness	No	No	Yes	Yes
Efficiency	N/A	No	Yes	Yes, max net benefits
Acceptability	Yes	No	Yes	Yes
National Economic Development Account				
Base Metal Concentrates Handling Cost	–	–	–	–
Increase Portsite Efficiency	No	Yes	Some Increase	Major Increase
Improve Portsite Capability	No	No	Some Increase	Major Increase
Reduce Transportation Cost	No	No	Minor Decrease	Major Decrease
Fuel	–	–	–	–
Increase Efficiency	No	No	Major Increase	Major Increase
Reduce Transportation Cost	No	No	Major Decrease	Major Decrease
General Cargo	–	–	–	–
Increase Efficiency	No	No	Minor Increase	Major Increase
Reduce Transportation Cost	No	No	No	Minor Decrease
Improve Delivery Goods and Services to NW arctic	No	No	Fuel	Fuel
Improve Portsite Safety	No	No	Yes	Yes
Environmental Quality Account				

	Alt 1 No Action	**Alt 2 Third Barge**	**Alt 9 Breakwater + Offshore Fuel Facility**	**Alt 11 Trestle-53' Channel + Fuel Facility**
Reduce Risk of Oil Spills	No Chng.	No Chng.	Some Increase	No Net Change
Reduce Marine Accidents	No Chng.	Some Increase	Decreased Risk	Decreased Risk
Reduce Total Marine Transits	No Chng.	Some Increase	Some Increase	Large Decrease
Minimize Impact to Marine Resources	No Impact	Yes, No Impact	No Sig. Impact	Minor Impact
Prevent Increase in Emissions and Spillage Over Water	No Chng.	No, More Vessels	Some Decrease	Decrease
Minimize Adverse Effects of Bottom Dredging	No Work	No Work	Yes, With Proper Mit.	Yes, With Proper Mit.
Littoral Drift Blockage	No Chng.	No Chng.	Some Increase	Some Increase
Minimize Dredged Material Disposal Effects	No Work	No Work	Yes, With Proper Mit.	Yes, With Proper Mit.
Protect Sensitive Arctic Environment	No Work	Minimal Impact	Yes, No Sig. Impact	Yes, No Sig. Impact
Mitigate Significant Impacts	No Work	No Sig. Impacts	None Anticipated	None Anticipated
Develop Environmentally Acceptable Cnstr. Methods	No Work	No Work	Yes	Yes
Determine Envrn. Accept. Operation and Maint. Proc.	No Work	No Chng.	Yes	Yes
Regional Economic Development Account				
Improve Transportation to DeLong Zinc Belt	No	No	No	Yes, Imprvd Import Ability
Provide Capability for Portsite Capacity Expansion	No	Minor Increase	Some Increase	Yes, Space For 2nd Cnvy.
Increase Safety of Portsite to Handle Increased Throughputs	No	No	Yes, Reduced Waves	Yes, Major Improvement
Reduce Fuel Shipping Costs	No	No	Major Reduction For Fuel	Yes, Major Reduction for Fuel
Reduce Cargo Shipping Costs	No	No	Minor Reduction for Cargo	Some Reduction for Cargo
Other Social Effects Account				
Minimize Adverse Impacts to Subsistence Hunting	Yes, No Chng.	Yes, No Chng.	Yes, Minimize Impacts	Yes, Minimize Impacts
Minimize Adverse Impacts to Subsistence Fishing	Yes, No Chng.	Yes, No Chng.	Yes, No Chng.	Yes, No Chng.
Minimize Adverse Impacts to Subsistence Gathering	Yes, No Chng.	Yes, No Chng.	Yes, No Chng.	Yes, No Chng.
Technical Criteria				

	Alt 1 No Action	Alt 2 Third Barge	Alt 9 Breakwater + Offshore Fuel Facility	Alt 11 Trestle-53' Channel + Fuel Facility
Provide Technically Appropriate Bulk Material				
Handling Systems	Yes	Yes	Yes	Yes
Provide Sufficient Capacity for Throughputs	No	Yes	Yes	Yes
Provide Design for Severe Winter Ice Conditions	Yes	Yes	Yes	Yes
Provide Design for Short Open Water Period	Yes	Yes	Yes	Yes
Provide Design for Unsheltered Sea Conditions	Yes	No	Yes	Yes
Provide Design Maximizing Operational Reliability	No	No	Yes	Yes
Provide Design with Ease of Maintenance	Yes	Yes	Yes	Yes
Avoid Significant Rstrc. on Portsite Ops. During Cnstrc.	Yes	Yes	Yes	Yes
Avoid Reducing the Shipping Season	No Change	Yes	Yes	Yes
Minimize Future Weather Downtime	No	No	Yes	Yes
Provide for Expandability for Future Users	No	No	Yes, For Fuel	Yes
Provide Sufficient Capacity for Off Loading Fuel,	No	No	No	Yes
General Cargo, and Consumables	No	No	No	Yes
Provide Vehicle Access to Dock Structure				

5.0 TENTATIVELY RECOMMENDED PLAN

5.1. Purpose of Section 5

The purpose of this section of the draft IFR is to provide more detailed information on the Tentatively Recommended Plan, Alternative 11. The measures that make up the general navigation features and the local service facilities are clearly separated, the responsibility for each stated, and the apportionment of costs (cost sharing) between the Federal Government and the non-federal local sponsor explained. The initial draft Sponsor's Financial Plan is identified.

5.2. Description of Tentatively Recommended Plan Components

The tentatively recommended plan, Alternative 11, was found to maximize NED benefits and, thus, is the NED Plan. This alternative is also supported by the local sponsor, AIDEA. The tentatively recommended plan is shown on the plates following this report. The plan includes: the GNF of dredging of seabed material to form a deep-draft channel serving a new dock at Portsite and disposal of that material in a new ocean dump site to be considered for designation by EPA, the LSF including a new deep-draft dock with concentrate shiploader(s) and fuel transfer facilities, a trestle with enclosed conveyor for moving the concentrate from storage buildings on land to the shiploaders, and necessary upland facilities. The existing conditions for Portsite are shown on Plate 2 with the offshore geotechnical profile shown on Plate 11. Construction would occur over a 3-year period due to the challenges posed by arctic construction during temperature and weather extremes and the short open-water summer shipping season. Construction procedures would be implemented to minimize significant adverse impacts to fish and wildlife habitat near Portsite and to critical subsistence hunting, fishing, and gathering activities of Alaska Natives.

5.2.1. General Navigation Features

The general navigation features of this project would provide a deep-draft navigation channel dredged to a design depth of –53 feet MLLW, which would begin about 1,100 feet offshore and run seaward for 18,574 feet along a bearing of N72°38'27"E (see plate 3). The channel has a complex geometry that was previously discussed in detail in Section 3 (see plate 4). In general, the channel is 213 feet wide at its landward end and is located immediately north of the 214-foot-wide by 900-foot-long berthing area on the north side of the deep-draft dock. The channel flares to about 1,170-feet-wide about 3,700 feet offshore to facilitate the departure of loaded concentrate bulk vessels. The channel then narrows to 760 feet wide 5,000 feet offshore and then gradually narrows to 500 feet wide at its seaward end. To facilitate turning the inbound vessels, a turning basin with a maximum width of 435 feet is provided south of the channel immediately west of the dock.

The initial channel dredging is based on providing a side slope of 1 vertical to 3 horizontal. This slope is expected to eventually lay back to a 1 vertical to10 horizontal slope. The area of seabottom disturbed is 330 acres for the 1:3 slope and 400 acres for the 1:10 slope (plates 4 and 5). The initial design dredging quantities (including the allowable overdepth dredging) total 6,245,234 yd^3, with 5,189,829 yd^3 coming from the channel, 562,077 yd^3 from the turning basin, and 493,278 yd^3 from the berthing area. A sump (plate 6) would be created by initially dredging the channel an additional 5 feet deep from a point about 7,500 feet offshore to the landward end of the channel and an additional 2 feet deep from that point to the seaward end of the channel for a total of 1,896,190 yd^3. The total amount of initial dredging would be 8,141,424 yd^3. If the slopes lay back on a 1:10 slope, an additional 30 acres of seabottom would be affected. Channel maintenance is expected to be needed in project years 5, 17, 33, and 49. The dredged material would be disposed of 5 to 7 miles offshore in a new ocean disposal site. The site is a rectangle about 2 miles roughly east-west and 4-1/3 miles roughly north-south in waters between -62 feet MLLW and -72 feet MLLW. Hopper dredges and/or clamshell scows would transport the material to the disposal site where they would open dump the materials. The disposal would be restricted to creating piles no larger than 5 feet above the seabottom. Initial dredging and disposal (including the sump) is expected to take three open-water seasons, with approximately one third or almost 3,000,000 yd^3 each season.

The Coast Guard will require a stationary navigational aid for the Portsite channel due to the long distance to the nearest Coast Guard Station. The aid selected is a set of two range towers located on the channel centerline. One tower could be located on the beach berm with the other on top of the new personnel accommodations complex.

5.2.2. Local Service Facilities

The LSF for this project include the construction of a deep-draft bulk carrier concentrate loading system to replace the current lightering bargeloading system and berth dredging. The new system would be located on a new dock with an access trestle on an alignment rotated 11 degrees to the north from the current loading system (plate 5). The new facilities would consist of a 90-foot-wide by 300-foot-long deep-draft dock about 1,450 feet offshore with a deck set at +40 feet MLLW. The dock would be equipped with two fixed radial concentrate shiploader(s) and fuel transfer facilities to offload ocean going tankers (55,000 dwt) (plate 9). Shiploader(s) would have a capacity of 2,600 tph and the fuel facilities (plates 7, 8, and 9) would offload at 7,500 U.S. gpm. A trestle (plates 7 and 10) would connect the dock with the shore and support vehicle access, an enclosed concentrate conveyor, and a fuel pipeline. Improvements to shoreside facilities would be required to support the operation of the new deep-draft dock. These would include improvements to the power generation and fire suppression system, to the old personnel accommodations complex, and other associated minor systems.

To provide an area to assemble and construct the trestle and for later access to the trestle, the 2.5-acre area between the trestle abutment and the fill for the personnel accommodations complex and the new gasoline tank area would be filled with 70,000 yd^3 of suitable material to an elevation varying from +25 feet MLLW to +32 feet MLLW (plate 5). Shoreside improvements include: a 12-inch fuel pipeline from the trestle to the existing Portsite tank farm with a booster pump and fuel monitoring facilities, a new 2-million-gallon gasoline tank, a 3,600 square-foot expansion of the existing Portsite power generation station to house two new CAT 3608 (2,208 kW) generators with associated electrical equipment, continuation of the enclosed conveyor on the trestle from the trestle abutment landward to the surge bin adjacent to the personnel accommodations complex, a refitting of the conveyor belt from the surge bin back to the concentrate storage buildings with a 48-inch belt, a fire protection system upgrade to protect the new shiploading facilities, and a refurbishment of the old personnel accommodations complex to serve an estimated increased need of 100 beds for the construction workers. The exact configuration of the upland facilities may be modified when detailed designs are developed.

5.2.3. Real Property Interests

AIDEA will be required to provide all lands, easements, and rights-of-way necessary for access, construction, operation, and maintenance of the project. The government's right of navigational servitude will be exercised for tidelands below Mean High Water to include the deep-draft channel with its turning basin and the open-water dredge disposal area (plate 8). These rights cover all the GNF areas. AIDEA will be responsible for acquiring all the necessary real estate interests required for the LSF. AIDEA has a long-term land lease from NANA, which covers the uplands for the project. AIDEA and TCAK have a long-term lease agreement for priority, non-exclusive use of the DMT facilities. They also have a State Tidelands lease. There are no relocations of utilities or roads anticipated for this project. There are no known hazardous and/or toxic waste on the land required for the project. Table 34 provides a summary of the land requirements for the project, identifying both land required for GNF features and that required for LSF.

Table 34. Summary of Required Real Estate Interests

Feature	Acres	Owner	Interest
General Navigation Features			
Channel & Turning Basin Dredging	523.06	State & International	Navigational Servitude
Range Towers	0.11	NANA	Leasehold Estate
Dredge Disposal Area	5,600.00	International	Navigational Servitude
ByPass Dredge & Fill Area	1.92	State & NANA	Nav Serv & Leasehold
Local Service Facilities			
Trestle, Dock, Berthing Area	21.08	State	Leasehold Estate
Fill Area for Structures	2.85	NANA	Leasehold Estate
Gasoline Storage Tank	0.78	NANA	Leasehold Estate
Fuel Pipeline	0.85	NANA	Leasehold Estate

It is not anticipated that the sponsor will have to provide any LERR for construction, operation, and maintenance of the GNF and, therefore, no credit is estimated. The estimated LER cost for the tentatively recommended plan are presented in table 35, based on the March 2003 price level without contingency. When adjusted to the October 2004 price level and a 25 percent contingency is included, the total estimated real estate cost is $13,318. The detailed Real Estate Plan is in Appendix D.

Table 35. Real Estate Cost Estimate

Item	Federal Cost	Non-Federal Cost	Total Cost
General Navigation Features (Federal)			
Real Estate Land Costs	0	0	0
Administrative Costs	$5,000	0	$5,000
Total Federal Real Estate	$5,000	0	$5,000
Local Service Facilities (non-Federal Sponsor)			
Real Estate Land Costs	0	$2,700	$2,700
Administrative Costs	0	$2,500	$2,500
Total non-Federal Real Estate	0	$5,200	$5,200
Total Real Estate Costs	$5,000	$5,2000	$10,200

5.2.4. Permit Requirements

A number of permits would be required to construct the tentatively recommended plan. These are discussed in more detail in the draft EIS. Table 36 provides a summary of the permits that will be required prior to start of construction of a project. The permit requirements cover both GNF and LSF features. Some permits would be new permits, but many would be modifications of existing permits.

Table 36. Summary of Construction Permit Requirements

Requirement	Type	Agency Administering	
Rivers and Harbors Act (1899)	Section 10 (structure in navigable waters)	Corps of Engineers (COE)	COE publishes public notice for review—no permit issued
Clean Water Act (1972)	Section 401-State water quality certification Section 404b(1) (wetlands)	Alaska Department of Environmental Conservation (ADEC) COE	Part of 10/404 review COE (EIS Appendix 1)—no permit issued
Marine Protection, Research, and Sanctuaries Act (1972) {33 CFR 320 and 325}	Section 103	COE w/EPA concurrence	COE (EIS Appendix 2)—no permit issued
Coastal Zone Management Act (1972)	Coastal Consistency review Title 9-Conditional Land Use Permit	ADGC Northwest Arctic Borough	Part of 10/404 review Part of coastal review
National Historic Preservation Act (1966)	Section 106 Review	Alaska Historic Preservation Officer	Part of 10/404 review
Clean Air Act (1963)	Air Quality Permit	ADEC/Environmental Protection Agency (EPA)	AIDEA applicant
Pollution Control Act	ODPCP (tanker fuel handling & storage)	ADEC	AIDEA applicant
National Pollutant Discharge Elimination System	Construction activities permit Industrial facility permit	ADEC/EPA ADEC/EPA	AIDEA applicant AIDEA applicant

5.3. Cost of Tentatively Recommended Plan

5.3.1. Cost Apportionment

Cost apportionment (sharing) is the dividing of the costs for a project between the Federal Government and the local sponsor. Project financial costs are the costs that are shared by the planning partners. Cost sharing for this project is proposed in accordance with the current law and policy regarding deep-draft navigation improvement projects. The general formulas set up by Congress to determine the local sponsor's share of implementation costs are shown in table 31. Table 37 provides a summary of the estimated cost apportionment between the federal and the non-federal interests for the tentatively recommended plan.

Table 37. Cost Apportionment

Cost Category	Federal %	Local %
General Navigation Features (GNF) 1/		
Channel & Turning Basin Dredging--up to 20 ft depth	90	10
Channel & Turning Basin Dredging--20 ft to 45 ft deep	75	25
Channel & Turning Basin Dredging—greater than 45 ft deep	50	50
Allowable Overdepth Derdging (AOD)	2/	2/
Required Overdepth Dredging For Efficient Maintenance (RODFEM)	3/	3/
Lands, Easements, Rights-of-Way, and Relocations	0 5/	100 4/
Operation & Maintenance Dredging—up to 45 ft depth	100	0
Operation & Maintenance Dredging—From 45 ft to design depth	50	50
Local Service Facilities (LSF)		
Berth Area Dredging	0	100
Associated Dock and Shore Facilities	0	100
Lands, Easements, Rights-of-Way, & Relocations	0	100
Operation & Maintenance	0	100
Coast Guard Navigational Aids	100	0

1/ Local sponsor must provide an additional cash contribution equal to 10% of the total GNF, plus interest, to be paid over a period not to exceed 30 years from completion of construction. Sponsor's cost for LER required for the GNF features, except utilities, is credited against the 10%.

2/ AOD is cost shared in the same percentage as the design depth.

3/ RODFEM is cost shared by dividing the total RODFEM volume into portions for each depth zone and the berth area based on the percentage of dredging volume attributable to each depth zone and the berth area for the initial project design.

4/ For a utility requiring relocation as part of an improvement deeper than 45 feet, the owner of the utility must pay 50% of the relocation costs and the non-Federal sponsor must pay 50% of the relocation costs (sponsor receives credit for the relocation cost against the additional 10% cash contribution). Highway and Railroad Bridges are cost shared with the owner first in accordance with the Truman-Hobbs Act (PL 77-647) and then any remaining costs not allocated to the owner are cost shared as part of the GNF.

5/ Federal Administrative Costs associated with the certification of lands by the local sponsor are considered part of the PED phase and cost shared initially 75% Federal and 25% non-Federal.

5.3.2. Implementation Costs

A detailed cost estimate was developed for the NED and tentatively recommended plan using the Corps of Engineers' Micro Computer Aided Cost Estimating Software (M-CACES). The complete M-CASES cost estimate based on the October 2004 price level is in Appendix C, Cost Engineering. Table 38 presents a summary of that cost estimate. The table shows that the total first cost of the project is $230,419,771, of which $37,041,086 is allocated to the

Federal Government cost and $193,378,685 to the non-federal sponsor. This includes, for both the GNF and the LSF, design and construction costs, mitigation costs, lands, easements, rights-of-way, and relocation (LERR) costs, RODFEM costs, and the additional 10 percent local sponsor contribution (assuming it is paid at the time of construction and accrues no interest). The dredging feature costs include a 25 percent contingency and the non-dredging features have a 20 percent cost contingency (LSF costs are based on a design memo level of detail). Table 39 presents the same project, but the costs have been projected in accordance with appropriate factors to form a “fully funded” cost estimate.

Table 38. Summary Cost Estimate for NED and Tentatively Recommended Plan

Cost Items	Total Project Cost	Cost Apportionment			
		Federal	%	Non-Federal	%
General Navigation Features (GNF):					
GNF/LERR—Federal Administrative Costs	6,529	6,529		0	
GNF/LERR—Sponsor's Real Estate Costs	0	0		0	
GNF Dredging Mob/Demob for up to 45 feet deep 2/	7,419,358	5,562,886	75	1,856,472	25
GNF Dredging Mob/Demob for greater than 45 feet deep 2/	7,705,845	3,852,922	50	3,852,922	50
GNF Dredging & Disposal for up to 45 feet deep 2/	22,248,609	16,686,457	75	5,562,152	25
GNF Dredging & Disposal for greater than 45 feet deep 2/	23,087,387	11,543,693	50	11,543,693	50
Fish & Wildlife Mitigation Attributable to GNF	0	0		0	
Sub-total GNF Construction	60,467,728	37,652,488		22,815,240	
Dredging--Preconstruction Engineering & Design 1/	4,104,923	3,078,692	75	1,026,231	25
GNF Dredging—Engineering & Design 2/	907,016	564,788		342,229	
GNF Dredging--Construction Managemen 2/	3,480,090	2,167,008		1,313,082	
GNF Dredging--Project Management 2/	907,016	564,778		342,229	
TOTAL GENERAL NAVIGATION FEATURES	69,866,774	44,027,764		25,839,010	
Non-Federal reimbursement Funding (Additional 10% over 30 Years)		-6,986,677		6,986,677	
GNF LERR credit (ESTIMATED)		0		0	
Non Federal Post Construction Contribution		-6,986,677		6,986,677	
ESTIMATED ULTIMATE GNF COST SHARING TOTAL	69,866,774	37,041,086		32,825,688	
Aids to Navigation	34,000	34,000	100	0	0
Local Service Facilities (LSF)					
Berth Dredging—Mob/DeMob 2/	1,173,591	0	0	1,173,591	100
Berth Dredging—Berth Area 2/	3,516,181	0	0	3,516,181	100
Dredging—Preconstruction Engineering & Design 1/	0	0	0	0	100
Berth Dredging—Engineering and Design 2/	70,347	0	0	70,347	100
Berth Dredging—Construction Management2/	269,910	0	0	269,910	100
Berth Dredging—Project Management 2/	70,347	0	0	70,347	100
Berth Dredging—sub-total	5,100,375	0	0	5,100,375	100
Dock, Trestle, Conveyor, Fuel Tank, & Associated Facilities	130,668,358	0	0	130,668,358	100
Fish and Wildlife Mitigation—General	1,305,600	0	0	1,305,600	100
Fish and Wildlife Mitigation—Shoreline Bypass Dredging	325,000	0	0	325,000	100
Fish and Wildlife Mitigation—sub-total	1,630,600	0	0	1,630,600	100
LSF/LERR—Local Sponsor costs	6,789	0	0	6,789	100
LSF--Owner's Costs	7,821,851	0	0	7,821,851	100
LSF--Planning, Engineering, and Design Costs	6,458,149	0	0	6,458,149	100
LSF--Construction Management Costs	8,866,875	0	0	8,866,875	100
TOTAL LOCAL SERVICE FACILITIES	160,552,997	0	0	160,552,997	100
PROJECT TOTAL NED IMPEMENTATION COSTS	230,419,771	37,041,086	16	193,378,685	84

1/ The cost sharing shown is the initial allocation under provisions of the model Design Agreement. Actual cost sharing percentages will be based on actual costs incurred and final accounting following completion of construction. This would increase the local share by about an additional $400K.

2/ Costs are allocated between cost sharing depths and berth area based on total volumes of each.

Table 39. Fully Funded Estimate for NED and Tentatively Recommended Plan

Cost Items	**Total Project Cost**	**Cost Apportionment**			
		Federal	%	Non-Federal	%
General Navigation Features (GNF):					
GNF/LERR—Federal Administrative Costs	6,704	6,704		0	
GNF/LERR—Sponsor's Real Estate Costs	0	0		0	
GNF Dredging Mob/Demob for up to 45 feet deep 2/	8,053,809	6,038,681	75	2,015,128	25
GNF Dredging Mob/Demob for greater than 45 feet deep 2/	8,364,396	4,182,198	50	4,182,198	50
GNF Dredging & Disposal for up to 45 feet deep 2/	24,150,005	18,112,503	75	6,037,501	25
GNF Dredging & Disposal for greater than 45 feet deep 2/	25,060,465	12,530,233	50	12,530,233	50
Fish & Wildlife Mitigation Attributable to GNF	0	0		0	
Sub-total GNF Construction	65,365,379	40,870,319		24,765,060	
Dredging--Preconstruction Engineering & Design 1/	4,236,066	3,177,049	75	1,059,016	25
GNF Dredging--Engineering & Design 2/	987,406	614,845		372,561	
GNF Dredging--Construction Managemen 2/	3,788,534	2,359,072		1,429,462	
GNF Dredging--Project Management 2/	987,406	614,845		372,561	
TOTAL GENERAL NAVIGATION FEATURES	75,634,789	47,636,130		27,998,659	
Non-Federal reimbursement Funding (Additional 10% over 30 Years)		-7,563,479		7,563,479	
GNF LERR credit (ESTIMATED)		0		0	
Non Federal Post Construction Contribution		-7,563,479		7,563,479	
ESTIMATED ULTIMATE GNF COST SHARING TOTAL	75,634,789	40,072,651		35,562,138	
Aids to Navigation	36,906	36,906	100	0	0
Local Service Facilities (LSF)					
Berth Dredging—Mob/DeMob 2/	1,273,887	0	0	1,273,887	100
Berth Dredging—Berth Area 2/	3,816,679	0	0	3,816,679	100
Dredging—Preconstruction Engineering & Design 1/	0	0	0	0	100
Berth Dredging—Engineering and Design 2/	76,581	0	0	76,581	100
Berth Dredging—Construction Management2/	293,832	0	0	293,832	100
Berth Dredging—Project Management 2/	76,581	0	0	76,581	100
Berth Dredging—sub-total	5,537,561	0	0	5,537,561	100
Dock, Trestle, Conveyor, Fuel Tank, & Associated Facilities	141,763,780	0	0	141,763,780	100
Fish and Wildlife Mitigation—General	1,364,617	0	0	1,364,617	100
Fish and Wildlife Mitigation—Shoreline Bypass Dredging	339,691	0	0	339,691	100
Fish and Wildlife Mitigation—sub-total	1,704,308	0	0	1,704,308	100
LSF/LERR—Local Sponsor costs	6,973	0	0	6,973	100
LSF--Owner's Costs	8,347,991	0	0	8,347,991	100
LSF--Planning, Engineering, and Design Costs	6,637,503	0	0	6,637,503	100
LSF--Construction Management Costs	9,455,611	0	0	9,455,611	100
TOTAL LOCAL SERVICE FACILITIES	173,453,726	0	0	173,453,726	100
PROJECT TOTAL FULLY FUNDED IMPEMENTATION COSTS	249,088,515	40,072,651	16	209,015,864	84

1/ The cost sharing shown is the initial allocation under provisions of the model Design Agreement. Actual cost sharing percentages will be based on actual costs incurred and final accounting following completion of construction. This would increase the local share by about an additional $400K.

2/ Costs are allocated between cost sharing depths and berth area based on total volumes of each.

5.3.3. Operation, Maintenance, Repair, Replacement, and Rehabilitation Costs

5.3.3.1 Dredging Operation and Maintenance Costs (including berthing area)

The tentatively recommended plan would involve the creation of a sump with a capacity of about 1,900,000 yd^3 to provide for the RODFEM previously discussed. This sump provides storage for the 50-year sedimentation event, for average annual sedimentation, and for side slope deterioration. Maintenance dredging would be performed in project years 5, 17, 33, and 49. The average annual cost associated with maintenance dredging, which includes the annual 26,000 yd^3 of annual littoral bypassing mitigation, is $1,245,246. The derivation of these figures is found in Appendix A.

The periodic O&M dredging would be cost shared in the same proportion as the relative dredging volumes between the initial GNF channel and turning basin dredging zones and the LSF berthing area. Table 40 shows this relationship. The zone for channel and turning basin up to 45-feet-deep (45.54 percent of total volume) would be a 100 percent federal responsibility. The zone greater than 45 feet deep (47.26 percent of total volume) would be cost shared 50 percent federal and 50 percent non-federal. The berthing area dredging (7.20 percent of total volume) would be a 100 percent local responsibility. Thus, the overall blended cost sharing for the periodic maintenance of the channel, turning basin, and berthing area would be 69.17 percent federal cost and 30.83 percent non-federal cost, with the annual bypass dredging of $325,000 being 100 percent non-federal cost.

Table 40. O&M Cost Apportionment by Dredging Volumes

	Dredging Volume (cy)	Dredging Percentage	Federal Portion	Non-Federal Portion
Cost Zone				
Channel & Turning Basin < = 45 feet	3,707,803	45.54%	45.54%	0.00%
Channel & Turning Basin > 45 feet	3,847,588	47.26%	23.63%	23.63%
Berthing Area	585,983	7.20%	0.00%	7.20%
Total Initial Dredging	8,141,374	100.00%	69.17%	30.83%
Average Annual Dredging Costs	Dredging Cost			
Total Average Annual O&M Dredging	$1,245,246		$636,534	$608,712
Annual By-Pass Dredging	100.00% $325,000		0.00% $0	100.00% $325,000
Annual Channel/Basin/Berth Dredging	100.00% $920,246		69.17% $636,534	30.83% $283,712

5.3.3.2. Dredged Material Management Plan

Corps' guidance, the Planning Guidance Notebook, ER1105-2-100, requires that feasibility reports that recommend dredging and disposal of materials for navigational purposes include a Dredged Material Management Plan (DMMP). The expected components include (1) alternative analysis; (2) assessment of beneficial uses; (3) involvement and coordination with appropriate stakeholders and other non-federal interest; and (4) environmental consistency. A suggested report outline includes the following major headings: (1) project description; (2) study scope; (3) authorization and development history; (4) existing conditions; (5) without-project conditions; (6) problems and opportunities; (7) alternative plans; (8) trade-off analysis; (9) plan selection; (10) plan description; (11) coordination; (12) recommendations; and (13) NEPA documentation. A stand-alone separate DMMP has not been prepared for this study. The required information has been fully integrated into the feasibility report and environmental impact statement formats. In essence, the draft feasibility report and particularly the draft EIS with all of their appendixes form the DMMP for practical purposes.

5.3.3.3. Local Service Facilities Operation and Maintenance Costs

The annual operating costs for the future operation of the improved Portsite facility was evaluated by AMEC and a cost estimate was developed. The anticipated costs include: labor, catering and accommodations, tug and barge costs, Portsite fuel consumption, maintenance costs for the marine and structural, mechanical and electrical, and associated systems, and some additional administrative costs. The total value for OMRR&R for the LSF is $6,550,459. The total project OMRR&R annual cost is $7,795,705. Table 41 provides the total project O&M cost divided into federal and non-federal portions.

Table 41. Apportionment of Operation and Maintenance Costs

O&M Cost Category	Federal	Non-Federal	Total O&M
Channel, Turning Basin & Berthing Area	$636,534	$283,712	$920,246
Shoreline By-Pass Dredging	$0	$325,000	$325,000
Trestle, Dock, and Ancillary Facilities	$0	$6,550,459	$6,550,459
Total Project Operation & Maintenance	$636,534	$7,159,171	$7,795,705
Overall O&M Cost Allocation Percentage	8.17%	91.83%	100.00%

5.3.4. NED Costs

The average annual NED costs for a project include the amortized first cost, IDC, and OMRR&R costs based on a congressionally specified interest rate and project life. The project cost estimate analysis is based on cost estimates with an October 2004 price level, 5-3/8 percent interest rate, and a 50-year economic analysis period. The total implementation cost was $230,419,771 and the project is expected to take 3 years to complete. Interest during construction (IDC) is added to the construction cost to account for the opportunity cost incurred during the time after the funds have been spent and before the benefits begin to accrue. IDC was calculated by matching the construction expenditure flow with the interest the funds could have accumulated had they been deposited in an interest-bearing account. The computed IDC totaled $20,415,841 making the total investment cost for the project $250,835,612. This value is then annualized and the estimated OMRR&R costs are added to create the Average Annual Cost for the project. The annualized investment cost totaled $14,543,603 and OMRR&R costs were estimated at $7,795,705, yielding a total average annual NED cost for the project of $22,339,308.

5.4. Benefits of Tentatively Recommended Plan

The tentatively recommended plan provides estimated total annual benefits of $26,898,700, including $10,788,300 for reduced tug and concentrate barge costs in the future, $3,333,200 in reduced port delay and queue costs, $1,707,900 for induced concentrate tonnage, $11,002,400 for reduced fuel delivery costs, and $66,900 associated with annual avoided costs for operations at Portsite. Annual economic costs of the preferred plan are estimated at $22,339,308, resulting in annual net benefits of $64,559,392 and a positive benefit to cost ratio of 1.20 to 1. The tentatively recommended plan is supported by the local sponsor, AIDEA, an Alaska State Agency.

5.5. Risk and Uncertainty

As in any planning process, assumptions made in an analysis are subject to error. Elements of risk and uncertainty can affect the design and performance of the project, its costs, and potential benefits. The most critical items affected by risk and uncertainty occur primarily in the hydraulic and economic analysis. Appendix A provides the detailed discussion of the development of the tide, wind, wave, sediment information used as a basis for development of the coastal engineering design parameters used to create the measures that were combined into alternatives that were considered during this draft interim feasibility study. A number of models were used to take observed information and create analyses. Risk and uncertainty considerations were discussed in Appendix A as the analyses were developed. Appendix E provides a detailed discussion in Section 17 of the sensitivity of the economics to changes in data and methods of analysis. Thirteen different factors are analyzed including: concentrate volume shipped, maintenance dredging cycle, tug and barge costs, reduction of risk in concentrate loading, first cost of the trestle, fuel savings per gallon, total annual volume of fuel, fuel distribution costs to villages, ship arrival schedule, type of tug, simulation model calibration, ddp draft vessel cost, and duration of vessel transits. When the benefit analysis selects all the low estimates as the prevailing value to use, the NED Plan benefits are reduced about 7 percent. When high side estimates are used, the NED Plan benefits rise about 50 percent. Economic justification appears good. Choosing the low value would result in average annual benefits of about $24,419,800, while choosing the high value yields $40,470,600 in benefits.

5.6. Plan Accomplishments

The tentatively recommended plan would meet the following planning objectives for the study:

- Facilitate the further development and advance the general prosperity and economic welfare of the Nation's economy by increasing the efficiency of the water transportation system for the concentrates from the Red Dog Mine, providing opportunities for additional employment.
- Improve the capability and safety of and reduce the costs of DMT to handle both exports and imports of petroleum products.
- Improve the delivery and reduce the costs of general goods and services to the residents of northwestern Alaska.
- Increase the capability and safety of DMT by reducing the current risk of concentrate spills, fuel leakage and spills, and total overall marine transits.
- Reduce environmental risks and protect the sensitive arctic environment, mitigating significant project impacts where reasonable.
- Reduce regional transportation costs, enabling further development of DMT as an element of the DMTS for the DeLong Zinc Belt to handle additional imports and exports from future development activities (most likely expanded or additional zinc/lead mine(s), copper mine(s), and/or coal mine(s) exports and imports of mining materials, fuel and petroleum products, and other supplies for Northwest Alaska).
- Provide port service to reduce the regional cost of living and support other future northwestern Alaska development.

5.7. Plan Implementation

The Water Resources Development Act of 1986 (PL 99-662) and various administrative policies have established the basis for the division of Federal and non-federal responsibilities in the construction, operation and maintenance of Federal water resources projects accomplished under the authority of the Corps. This is discussed in detail below.

5.7.1. Federal Responsibilities

The Federal Government in the guise of the Corps of Engineers is responsible for conducting and completing the Preconstruction Engineering and Design (detailed plans and specifications for the dredging of the channel and disposal of materials), advertising and administering the contract after authorization and receipt of federal and non-federal funds, and managing the construction phase. The Corps is responsible for supervisory and administrative support for the non-federal sponsor's LERRD activities and for project monitoring. In addition, the Environmental Protection Agency will perform its administrative and quasi-judicial role under Section 102 and 103 of the Marine Protection, Research, and Sanctuaries Act of 1972 to designate a new ocean disposal site in the Chukchi Sea off Portsite by amending the ocean dumping regulations site list (40CFR228.15) through the Federal Register rulemaking process.

5.7.2. Non-Federal Responsibilities

The specific detailed requirements of the non-federal sponsor are itemized in Section 7.2. In summary, the major items that AIDEA will be required to perform are:

- Enter into an agreement covering work to be conducted during Preconstruction Engineering & Design that covers the time from completion of the feasibility report until construction is authorized and construction funding is provided by Congress.
- Provide all lands, easements, rights-of-way, and relocations required for construction of the project.
- Provide cash contributions toward construction of the GNF according to formulas originally set by Congress in 1986:

10 percent of the costs attributable to dredging to a depth not in excess of 20 feet (dredging on this project begins at the -20 foot contour).

25 percent of the costs attributable to dredging to a depth in excess of 20 feet but not in excess of 45 feet.

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

- Required overdepth dredging for efficient maintenance will be accomplished and cost shared in the same percentages as costs assigned to the project depth.
- An additional 10 percent of the costs attributable to the construction of general navigation features minus the value of LERR to be paid with interest over 30 years.
- In the case of a deep-draft harbor, 50 percent of the excess cost of operation and maintenance of the project over the cost that would be incurred if the project had a depth of 45 feet.
- Hold and save the United States free from all damages arising from the construction, operation, maintenance, repair, replacement, and rehabilitation of the project, any betterments, and the local service facilities, except for damages due to the fault or negligence of the United States or its contractors.
- Provide, operate, maintain, repair, replace, and rehabilitate, at its expense, the LSF
- Have responsibility for identifying and addressing any problems that would be regulated under the Comprehensive Environmental Response, Compensation, and Liability Act.

5.8. Sponsor's Financial Plan

AIDEA, the non-federal sponsor, is willing and able to share the costs of project implementation. AIDEA is planning to finance the non-federal portion of project costs through funds obtained from the State of Alaska, Department of Transportation and Public Facilities. The State of Alaska expects to request funds from the Alaska State Legislature. AIDEA has provided a letter, dated February 4, 2005, indicating both AIDEA's and DOT&PF's financial support for the tentatively recommended plan (see Appendix G). A confirming letter from DOT&PF, dated January 28, 2005, is also included.

5.9. Tentative Review Schedule for Feasibility Report

Following completion of a draft of the final Interim Feasibility Report and EIS by the Alaska District (currently scheduled for Winter 2005-2006), the Pacific Ocean Division Engineer in Honolulu will send the documents along with the report summary to the Civil Works Review Board in Washington, D.C. The draft final IFR and EIS will be reviewed by the CWRB and both the District Engineer and the Division Engineer will brief the CWRB. Following approval by the CWRB, the final IFR and EIS will begin their Washington D.C. level review by State and Federal agencies, as required by the Flood Control Act of 1944, and the final EIS will begin its required public review. At that time the District and the local sponsor can sign a design agreement covering the continuation of design work, while the upper level review is ongoing. The project could be authorized by Congress in a Water Resources Development Act, which normally happens in even years (i.e., 2006 or 2008). If so authorized in 2006, construction funding might be budgeted by the Administration for FY 2008. Physical construction is expected to occur over a period of 3 fiscal years (possibly 2009 -2011) with Corps Construction General funding being provided for those years plus possibly FY 2008. Once construction funding is received, the District and the local sponsor can sign a Project Cooperation Agreement, a legal document that would elaborate on the items identified in Section 7.2. The non-federal sponsor must provide their cost-sharing funds and real estate for the GNF at the beginning of construction (prior to award of the dredging and disposal contract).

6.0 REPORT REVIEW

6.1. Purpose of Section 6

The purpose of this section of the draft IFR is to provide summary information on the report review process to date. The recommendations provided by the U.S. Fish and Wildlife Service (USFWS) as part of their draft Coordination Act Report (CAR), Appendix 3 to the draft EIS, are identified and evaluated in the following sections. The views of cooperating agencies, the project sponsor, stakeholders and the general public will be included when received.

6.2. Views of the Fish and Wildlife Service/National Marine Fisheries Service

As part of the feasibility study process, the Corps coordinates with the U.S. Fish and Wildlife Service (USFWS) and the National Marine Fisheries Service (NMFS) in accordance with a number of laws. Some of the most significant legislation includes Section 2b of the 1958 Fish and Wildlife Coordination Act, which requires USFWS/NMFS to produce Planning Aid Letters and a Fish and Wildlife Coordination Act Report (CAR) to accompany the Corps report, and Section 7 of the 1973 Endangered Species Act, which requires the preparation of a draft Biological Opinion (BO) that reviews a Corps prepared Biological Assessment regarding the impact of a proposed action on threatened or endangered species.

Under the Fish and Wildlife Coordination Act, the U.S. Fish and Wildlife Service in cooperation with the National Marine Fisheries Service produced Planning Aid Letters and a draft Fish and Wildlife Coordination Act Report (CAR), dated January 2005, which forms Appendix 3 of the draft EIS. They evaluated the alternatives covered in detail in this report and accompanying draft EIS. They identified the impacts associated with the Third Barge Alternative (Alternative 2) to be primarily associated with additional noise from more tugboats and one additional barge. The USFWS believes that potential impacts to fish and wildlife resources associated with the No-Action (Alternative 1) and Third Barge Alternatives to be “minimal and ephemeral.” They believe that the Breakwater and Offshore Fuel Facility Alternative (Alternative 9) also would have minimal impacts associated with noise and siltation due to the one-time dredging activities during construction. However, Alternative 9 could impact fish and wildlife resources through oil spills at the fuel transfer facility. These impacts could range from mortality through direct oiling, to chronic impacts such as deformities and reduced reproductive potential associated with low-level, persistent pollution.

The USFWS believes that the Dredged Channel with Deep Draft Dock and Trestle (Alternative 11) could have significant impacts to fish and wildlife. These include impacts to migratory birds caused by the birds hitting the above-water structures and suffering injury and/or mortality and impacts to benthic environment associated with periodic channel dredging over the 50-year period, resulting in periodic mortality of epibenthic invertebrates such as crab and sea stars. However, due to a natural and regular rate of disturbance of the seabed due to storms and ice gouging, the USFWS does not expect these impacts to be permanent.

There were five specific recommendations made in the CAR. These are summarized as follows:

- Lighting Design. A detailed lighting design plan should be developed, keeping conveyor and road lighting, internal and exterior lighting to the minimum necessary for safe working conditions. All exterior lights should be shielded (directed downward).
- Bird Collection Apparatus. A mechanism to catch birds that strike the Dock/Trestle should be installed along both sides and monitored daily during migrations. The species, date, weather, and location of bird recovery should be reported to the USFWS.
- Radar Study. A radar study monitoring bird movement along the DMT facilities during spring and fall migration should be conducted pre and for a minimum of 5 years post project construction. If bird collisions become a problem, the study should consider changes to the lighting system to reduce the problem.
- Fuel Spill Containment. A state-of-the-art leak detection system should be installed on all fuel lines and containment measures, such as booms, should be used during fuel transfers.
- Fuel Transfer Operating Standards. Operating standards should be established for the additional fuel transfers at DMT. Revisions to the existing oil spill response plan should be developed and approved by the Alaska Department of Environmental Conservation.

Under the Endangered Species Act, the USFWS produced a draft BO, dated January 2004, which forms Appendix 5 of the draft EIS. In their BO they evaluated the Corps' BA, which identified potential impacts on spectacled and Steller's eiders resulting from implementation of the Corps' tentatively recommended plan. They determined that the actions outlined in the Corps' BA and draft EIS are not likely to jeopardize the continued existence of the spectacled and Steller's eider, and are not likely to destroy or adversely modify designated critical habitat. There is no designated or proposed critical habitat in Northwest Alaska for Steller's eiders (nearest is in Norton Sound about 250 miles south). The USFWS estimated that 18 spectacled and 3 Steller's adult eiders would be taken during the life of the project, equating to respectively 0.36 and 0.06 eiders per year. This taking would result from the fatal collision of eiders with the proposed trestle, dock, and/or associated infrastructure at DMT. However, almost all eider's encountering the improvements are likely to miss or avoid the new obstructions and the USFWS will not refer the incidental take of any migratory bird for prosecution, provided the take is in compliance with terms and conditions in the BO.

The USFWS believes the following measures are necessary to minimize take of Steller's and spectacled eiders:

Lighting/Marking Protocol. To minimize eider strikes, a protocol will be developed by the Corps and the USFWS (in compliance with Federal Aviation Administration regulations) regarding lighting/marking trestle dock and associated structures. The goal would be to minimize light radiating outward and to improve visibility of structures to migrants.

Catchment System. A system would be designed and installed along the length of both sides of all infrastructure extending over water. The system would be monitored daily for birds. Bird strikes (species, weather, location) would be reported to the USFWS.

In addition, the USFWS recommended participation in conservation programs for the benefit of endangered and threatened species. These conservation recommendations are discretionary agency activities to minimize or avoid adverse effects of a proposed action on listed species or critical habitat to help implement recovery plans, or to develop new information. These programs included:

Migration Surveys. The Corps and AIDEA were encouraged to contribute to ongoing migration surveys and satellite telemetry efforts tracking migrants through the area.

Recovery Plans. The Corps and AIDEA were encouraged to work with the USFWS and other federal and state agencies in implementing recovery actions identified in Steller's and spectacled eiders recovery plans.

Radar Study. The USFWS recommended a radar study monitoring bird movement past Portsite during spring and fall migration be conducted both before and after construction pf the new proposed infrastructure. That study would examine the efficiency of lighting system and the effects of changing the lighting system if bird collisions become a problem. The study would run for 5 years after completion of construction, with annual reports and a final report provided to the USFWS.

The Alaska District has reviewed the recommendations of the USFWS in the draft CAR and included most in the tentatively recommended plan. Most of the reasonable and prudent measures the USFWS feels are necessary in the BO to minimize take of eiders likewise are included in the tentatively recommended plan. Some items, such as the bird catchment system and the radar monitoring study appear to have similar purposes and both may not be required. Discussions are ongoing between the Corps and the USFWS during the public review period of the draft report and draft EIS regarding the best method(s) to use for determining bird behavior around the new structures. The total mitigation package for the project will be determined following public review and included in the recommended plan in the final report/EIS.

{TO BE COMPLETED/REVISED FOLLOWING PUBLIC REVIEW}

6.3. Views of Cooperating Agencies

6.3.1. Environmental Protection Agency

(TO BE COMPLETED UPON RECEIPT OF VIEWS)

6.3.2. National Park Service

(TO BE COMPLETED UPON RECEIPT OF VIEWS)

6.3.3. Northwest Arctic Borough

(TO BE COMPLETED UPON RECEIPT OF VIEWS)

6.4. Views of the Non-Federal Sponsor, Alaska Industrial Development and Export Agency

(TO BE COMPLETED UPON RECEIPT OF VIEWS)

6.5. Views of Other Public Entities

(TO BE COMPLETED UPON RECEIPT OF VIEWS)

6.6. Public Involvement

6.6.1. Public Scoping Meetings

Early in the feasibility study, the Corps conducted public scoping meetings in the city of Kotzebue and the villages of Noatak, Kivalina, and Point Hope. At these meetings the Corps listened to the interested individuals who attended and the concerns they had regarding further development at Portsite, the studies that should be done and the questions that should be answered.

The primary concern expressed centered on potential alternative impacts to the natural resources of the area and any subsequent impact to continued harvesting of the resources through the residents' subsistence activities. The marine biological resources, identified as being of particular concern, were: bearded seal, beluga and bowhead whale, ringed seal, char, salmon, shrimp, crab, plankton, and the other organisms that are important in the food chain. Concerns were also expressed about regional mining development that could adversely affect the ability of residents to get to and harvest subsistence plants and animals, that could adversely impact plants and animals important to the ecosystem and subsistence and that could lead to changes in traditional lifestyle, erosion of values, and undesirable change. A more detailed discussion of the scoping meetings is in the draft EIS.

6.6.2. Environmental and Cultural Coordination

Environmental studies included coordination with the USFWS, the NMFS, and with the cooperating agencies, EPA, NPS, and NWAB. Coordination was also maintained with Tribal, state, local governments and agencies, and interested groups and individuals. Under the Endangered Species Act, the District conducted informal and formal consultation with the USFWS, previously discussed in Section 6.2 .

Project features were developed to the design level required to complete a 404(b)(1) Evaluation during the IFS phase, and is included as Appendix 1 to the draft EIS. The Corps will coordinate with the State Department of Environmental Conservation to obtain Section 401 state water quality certification. Certification is usually done during Preconstruction, Engineering and Design (about 90 percent design level) when necessary information is developed. The Corps has requested a letter of support from the Department of Environmental Conservation. Cultural resource studies were conducted to locate, identify, and evaluate historic and prehistoric cultural resources possibly impacted by alternative measures. These tasks were accomplished in consultation with the Alaska State Historic Preservation Officer (SHPO). If required, site data recovery would occur during the project construction phase.

6.6.3. Public Meetings on Review of Draft IFR and EIS.

(TO BE COMPLETED FOLLOWING THE PUBLIC MEETINGS)

6.6.4. Public Comments Received on Draft IFR

(TO BE COMPLETED FOLLOWING THE END OF PUBLIC REVIEW)

7.0 CONCLUSIONS AND RECOMMENDATION

7.1. Conclusions

The tentatively recommended plan is the National Economic Development (NED) Plan as described in this report. The general navigation features for the project include the dredging of a channel to a design depth of –53 feet MLLW from about 1,100 feet offshore seaward for 18,574 feet, including an additional increment of over-depth dredging for RODFEM, and disposal of materials in an ocean disposal site 5 to 7 miles offshore. The channel width would vary from 500 feet wide at its seaward end to 760 feet wide about 4,500 feet offshore, to 1,169 feet wide about 3,300 feet offshore, and to 213 feet wide at its landward end. A turning basin and berthing area would be provided. The local service facilities needed for the project are a deep-draft dock and trestle from land to the dock that would support an enclosed concentrate conveyor and a roadway, twin fixed radial shiploaders, fuel transfer facilities, and general cargo facilities. The project would provide improved capability for annually moving about 1.544 million swt of base metal concentrate more efficiently, provide a tanker fuel transfer facility, and provide a general cargo transfer dock. The project will provide estimated annual benefits of $26,898,700, including $10,788,300 for reduced tug and barge costs, $3,333,200 for reduced queue and port delays, $1,707,900 for increased concentrate movement, $11,002,400 for reduced fuel transportation costs, and $66,900 in other avoided costs. Annual economic costs are estimated at $22,339,308, resulting in annual net benefits of $4,559,392 and a positive benefit to cost ratio of 1.20 to 1. The tentatively recommended plan is supported by the local sponsor, AIDEA.

The total implementation first cost is $230,419,771 (October 2004 price level), with $37,041,086 being the federal share and $193,378,685 being the non-federal share. The non-federal share includes $32,825,688 for their share of the cost of general navigation features and $160,552,997 for the cost of the local service facilities. Included in the above is the additional amount the local sponsor must repay ($6,986,677) within a 30-year period following completion of construction. Annual OMRR&R costs are estimated at $7,795,705 (October 2004 price level), with $636,534 being the federal share and $7,159,171 the non-federal share.

The studies documented in this report indicate that federal construction of the navigation improvements as described in the tentatively recommended plan, is engineeringly feasible, economically justified, and environmentally and socially acceptable. Of the four detailed alternatives evaluated in this study, Alternative 11 was found to maximize the net NED benefits. Thus, it was designated the NED Plan. AIDEA is willing to act as local sponsor for the tentatively recommended plan and fulfill all the necessary local cooperation requirements. Thus, it is concluded that Alternative 11, the tentatively recommended plan, should be pursued by the Federal Government in cooperation with AIDEA.

7.2. District Engineer’s Tentative Recommendation

I recommend that the tentatively recommended plan described herein for navigation improvements at DeLong Mountain Terminal, Alaska, be authorized for construction 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 initial total federal cost of $47,636,130 and $636,534 annually for federal maintenance, provided that prior to construction the local sponsor agrees to the requirements for non-federal sponsorship. Some of the major non-federal requirements are as follows:

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

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

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

- 10 percent of the costs attributable to dredging to a depth not in excess of 20 feet; plus
- 25 percent of the cost attributable to dredging to a depth in excess of 20 feet but not in excess of 45 feet; plus
- 50 percent of the costs attributable to dredging to a depth in excess of 45 feet; plus

Over-depth dredging undertaken to accomplish advanced maintenance and compensate for dredging inaccuracies to be cost shared as part of the general navigation features in the same percentage as the costs assigned to the project depth.

D. Pay with interest, over a period not to exceed 30 years following completion of the period of construction of the project, up to an additional 10 percent of the total cost of construction of general navigation features. The value of lands, easements, rights-of-way, and relocations provided by the non-federal sponsor for the general navigation features, described below, may be credited toward this required payment. If the amount of credit exceeds 10 percent of the total cost of construction of the general navigation features, the non-federal sponsor shall not be required to make any contribution under this paragraph, nor shall it be entitled to any refund for the value of lands, easements, rights-of-way, relocations, and dredged or excavated material disposal areas, in excess of 10 percent of the total cost of construction of the general navigation features;

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

F. Provide, operate, maintain, repair, replace, and rehabilitate, at its own expense, the local service facilities, consisting of the deep-draft dock with shiploader(s), vehicle access trestle with enclosed concentrate conveyor, tanker fuel transfer facilities and pipeline to onshore fuel storage tanks, a new fuel storage tank, vessel berth dredging and disposal of dredged materials, and associated improvements to power generation, fire suppression, personnel accommodations and other necessary upland 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. Accomplish all removals determined necessary by the Federal Government other than those removals specifically assigned to the Federal Government;

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

I. Hold and save the United States free from all damages arising from the construction, operation, maintenance, repair, replacement, and rehabilitation of the project, any betterments, and the local service facilities, except for damages due to the fault or negligence of the United States or its contractors;

J. Keep and maintain books, records, documents, and other evidence pertaining to costs and expenses incurred pursuant to the project, for a minimum of 3 years after completion of the accounting for which such books, records, documents, and other evidence is required, to the extent and in such detail as will properly reflect total cost of construction of the general navigation features, and in accordance with the standards for financial management systems set forth in the Uniform Administrative Requirements for Grants and Cooperative Agreements to state and local governments at 32 CFR, Section 33.20;

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

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

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

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

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, as well as Army Regulation 600-7, entitled “Nondiscrimination on the Basis of Handicap in Programs and Activities Assisted or Conducted by the Department of the Army.”

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

Q. In the case of a deep-draft harbor, provide 50 percent 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 45 feet; and

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

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

Date: _________________

Timothy J. Gallagher
Colonel, Corps of Engineers
District Enginee

DeLong Mountain Terminal
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