2.0 ALTERNATIVES

2.1 Introduction

2.1.1 Tentatively Recommended Plan

Consistent with the DMT draft interim feasibility report, this draft EIS identifies an alternative that the Corps may recommend to the Chief of Engineers for Congressional authorization. That alternative is the *tentatively recommended plan* in this draft EIS. After appropriate revisions following public review, it may be identified as the *recommended plan* in the final feasibility report and EIS.

The tentatively recommended plan is the Trestle-Channel Alternative. The remainder of this section describes how local and regional needs were identified and how solutions to meet those needs were developed and considered during the planning process.

2.1.2 Using Scoping in Alternatives Development

Comments about different ways to meet project objectives and regional needs were studied to identify possible solutions to those needs and objectives. Comments included suggestions on different ways to reduce the amount of fuel needed, to transport fuel, to transfer fuel, to transport ore concentrate, and to reduce transportation volumes. Scoping comments also suggested various different siting and routing options, some of which might tie into other transportation planning and/or needs.

Section 2.2 identifies and considers the feasibility of each alternative identified during scoping.

2.1.3 Changes in Initial Study Objectives

The reconnaissance studies that preceded the DMT draft EIS and feasibility report initially identified regional distribution of goods from a new airstrip at Portsite and increased capacity to load ore concentrate at Portsite as potential economic benefits of a Federal DMT navigation project. During the early phases of this study, it became evident that regional distribution of goods through Portsite would not be economically feasible. This objective was dropped from planning because it would cost more to develop and maintain infrastructure at Portsite for distribution of regional goods than to use the existing infrastructure at Kotzebue. Early plans for an airport at Portsite were dropped for the same reason; distribution of food, building materials, and other goods to meet regional needs can be handled at less cost from existing facilities at Kotzebue. If there was a need to fly fuel to users in Northwest Alaska, it could be flown at less cost out of Kotzebue or the existing Red Dog Mine airstrip than by constructing a new airstrip for that purpose at Portsite.

As the study progressed, it also became clear that additional annual loading capacity was not needed at Portsite and would not be needed in the foreseeable future. Existing loading capacity at Portsite is sized to handle existing mine throughput, although some additional capacity would be economically beneficial because it would allow ore concentrate to be loaded faster to minimize potential for ore concentrate to be left in storage at the end of the open-water season. Any new loading facilities should be sized to meet existing needs, although flexibility to allow future expansion would be considered in project design.

2.2 Alternatives Initially Considered

2.2.1 Alternative Concepts

Project alternatives were evaluated to meet two separate project needs related to transportation of ore concentrate and transportation of fuel. Alternatives initially considered to meet ore concentrate shipping needs can be roughly grouped in the following categories:

1. No Action
2. Develop a new land transportation system to an existing port or to a new port.
3. Develop alternative shipping methods to reduce costs and improve loading efficiencies using the existing loader and lightering systems.
4. Load ore concentrate directly into deep-draft bulk carriers for transoceanic shipping.

Alternatives that could reduce expenses and other problems with fuel transportation can be sorted into the following groups:

1. An offshore fuel line and terminal to off-load fuel directly from ocean-going tankers.
2. Fuel transfer facilities constructed along with facilities to load ore concentrate directly into deep-draft bulk carriers.
3. Develop alternative fuel sources or reduce fuel consumption.

2.2.2 No Action

This alternative would leave the existing operation at Portsite to continue as it does now and would not alter regional fuel transportation. Section 2.3 considers this alternative in detail.

2.2.3 Alternatives to Improve Ore Concentrate Shipping

Develop A New Land Transportation System. The alternatives considered in section 2.2.3 were developed in response to scoping comments suggesting that ore concentrate should be transported overland to another port. Scoping comments related to alternative ways to meet transportation needs and objectives focused on transportation and loading at a location other than Portsite. Construction of a road or railroad to the existing highway or railroad system was suggested in each of those comments. Construction of a new port that could serve both mining and community needs at Kotzebue or Nome also were considered in response to those scoping comments.

Transportation to Existing Port Sites. Alaska has a number of good deep-draft ports. However, the closest ports with existing deep-draft capability are at Seward and Whittier. The Port of Anchorage might be dredged deeper to allow loading of moderately deep-draft vessels. A port site at the West Forelands near Tyonek also is being considered for development and could be constructed to load ore concentrate. However, each of these ports is at least 600 miles from Red Dog Mine, and they are not connected to it through any road or railway system. The existing port at Nome is closer but cannot load deep-draft vessels. A channel could be dredged to deep water about 2 miles off the end of the existing causeway to allow loading of deep draft vessels. New loading facilities could also be developed closer to deep water at nearby Cape Nome. Locations of these existing ports and potential ports near population centers are shown in figure 2-1.

The three major problems with using any of these existing or proposed ports are: (1) construction expense, (2) transportation costs, and (3) social and environmental costs.

A highway from Red Dog Mine, or anywhere in the mineralized belt around it, to the closest existing port at Nome would require about 600 miles of heavy-duty road or railroad if the approximate routing in current regional transportation planning was used (figure 2-2). The road would bridge the Noatak, Kobuk, Buckland, and other major rivers of the region at a cost that likely would exceed $200 million even without considering land acquisition and environmental mitigation costs. Maintaining the 600 miles of road would be more expensive than the existing DMTS road connecting Portsite and Red Dog Mine. Trucks would take 2 days or more for each round trip to Nome, so more trucks would be required and costs per ton for drivers' wages, fuel, and maintenance would be much higher than for existing operations. The road would be constructed through major caribou migration routes, across important wetlands, and over major rivers essential to key fisheries resources. It would open Northwest Alaska up to much better access for residents and visitors, but would lead to social change that could be contrary to traditional values.

New ore concentrate storage buildings and other facilities, along with additional facilities for personnel and operations, would be required at Nome. One of the loading alternatives considered in detail in Section 2.3 would be required to transfer ore concentrate into ships. Altogether, new ore concentrate loading facilities would cost about the same to construct at Nome as at Portsite, with additional costs for construction at Nome for on-shore facilities that already exist at Portsite.

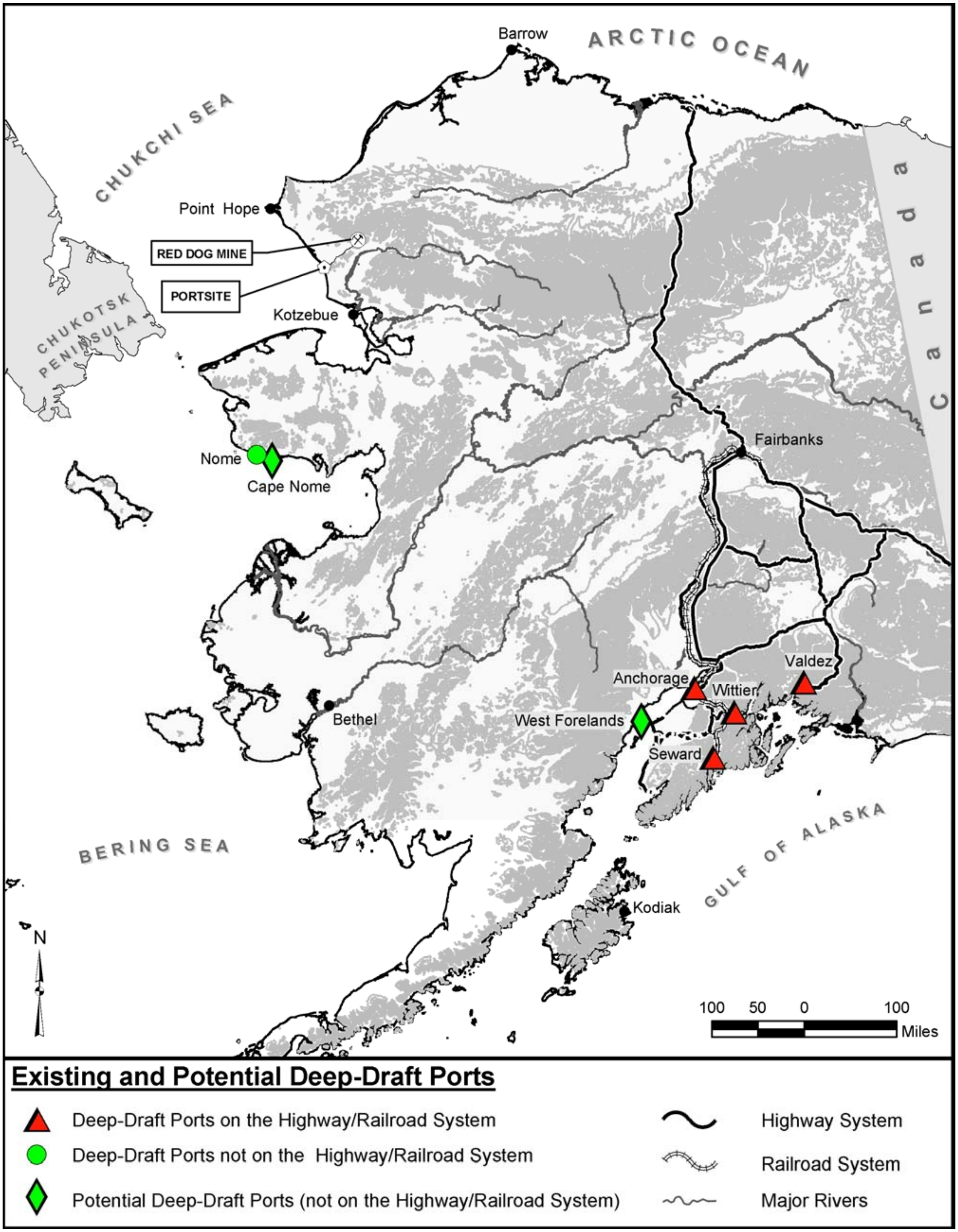

Figure 2-1. Existing and Potential Deep-Draft Ports.

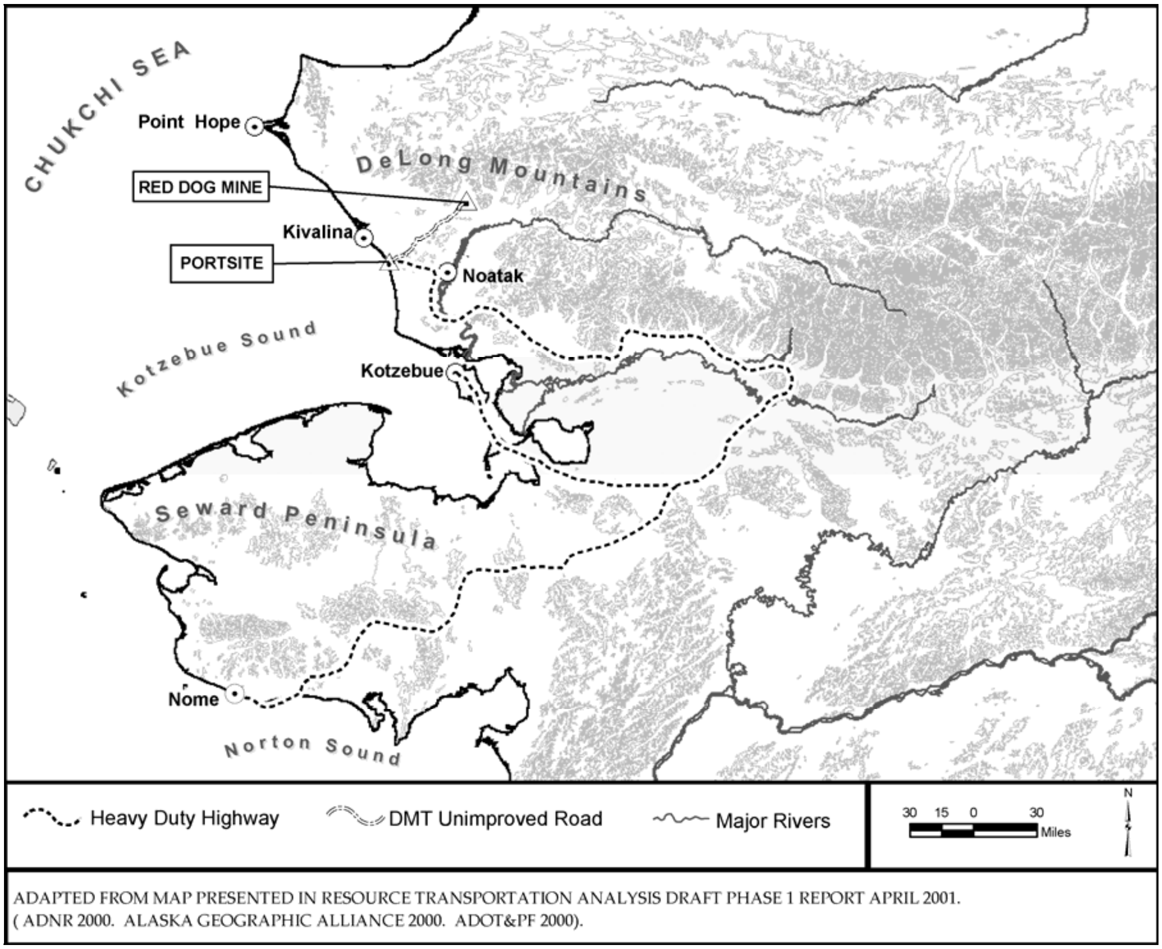

Figure 2-2. Possible heavy-duty highway route from Red Dog Mine to Kotzebue and Nome

Regional land transportation systems may someday connect the mineralized region around Red Dog Mine to shipping facilities at Nome. With the current state of development, land transportation to Nome would not be economically feasible as an alternative to meet the objectives of this study and could not be constructed under existing water resources development authorities. Regional transportation of this scope should be considered in a broader analysis of regional needs and alternatives, but costs would far exceed economic benefits required for a Federal water resources project, so this alternative is not carried into detailed consideration in Section 2.3.

Using other existing ports would present similar costs and environmental problems. Connecting the mineral region of Northwest Alaska with any of the ports in Southcentral Alaska would require construction of hundreds of miles of heavy-duty haul road to reach the existing road system or the Alaska Railroad. Figure 2-1 shows the locations of all the ports in Alaska on the road or railroad system that could load to deep-draft vessels. It also shows the existing highway and railroad system.

Where the haul road would meet the existing highway or railroad system, ore concentrate would be transferred to railcars or smaller trucks for the remainder of each trip because the big ore concentrate trucks used now between Red Dog Mine and Portsite would exceed load limits and vehicle widths allowed on highways. Concentrate storage buildings, loading facilities, and other new facilities would be required even at existing ports. A round trip by truck from Red Dog Mine to a railhead or highway north of the Alaska Range would take more than 2 days. Costs of road construction, new facilities construction, and operation and maintenance would far exceed the costs of using the existing loading system and could not be authorized under existing water resource development guidelines. The road, which would span important habitats, migration routes, and other valued ecological and cultural resources, would have major regional effects. This alternative would be uneconomical for the objectives of this study and would reach far beyond the identified needs and objectives. Use of any other existing port or of any location close to any existing port is not considered in detail as an alternative.

New Ports in Northwestern Alaska. Several sites for new ports were considered in the 1984 EIS for the Red Dog Mine. They were at Singoalik Lagoon, Tugak Lagoon north of Kivalina, and VABM 17 north of Portsite, in addition to the site selected for Portsite at VABM 28 (figure 2-3).

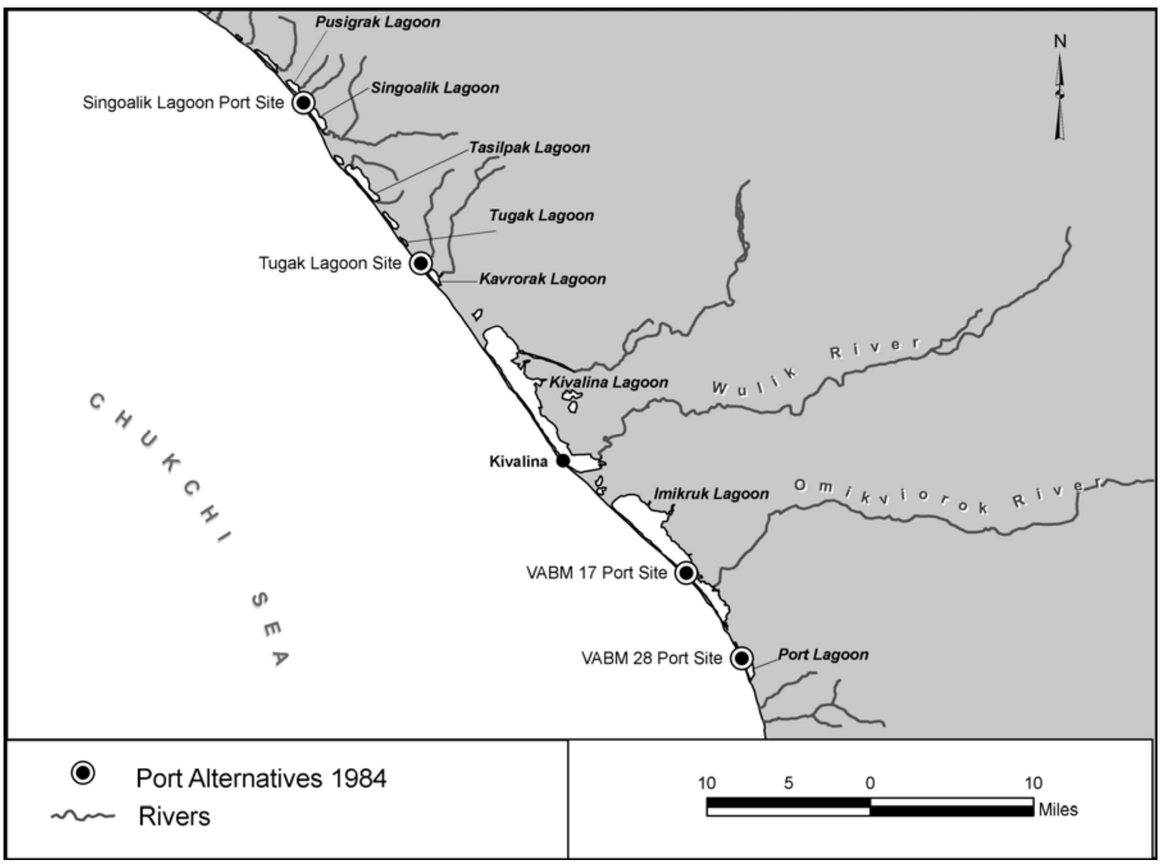

Figure 2-3. Port alternatives evaluated in the 1984 Red Dog Mine EIS.

Moving Portsite operations to a new site would require new roads and new construction of almost the entire Portsite infrastructure. This would be economically infeasible and would not resolve environmental concerns related to mining and mineral concentrate shipping in Northwest Alaska. These alternatives are not considered in detail in this draft EIS.

Kotzebue is on the Chukchi Sea, but is about 15 miles from deep water. Marine shipping to Kotzebue requires lightering from ocean-going barges. Cape Blossom, about 15 miles south of Kotzebue, is about the same distance from deep water as Portsite. A deep-water port to serve Kotzebue alone would not produce enough savings in shipping costs to justify a deep-water port at Cape Blossom. Comments during scoping suggested that a road could connect the Red Dog Mine area with Cape Blossom and that a deep-water port could be constructed at Cape Blossom to serve both Kotzebue and mining interests in northwestern Alaska.

Planning a project to serve as many users as possible is consistent with water resources development policy and guidelines. It also makes good environmental and economic sense. This alternative, however, would not produce enough economic benefits to justify construction under existing Federal authorities. The cost of developing and maintaining a road 250 to 450 miles long (depending upon whether or not it minimized impacts to national interest lands and major wetlands) between the DMTS and Kotzebue, combined with the cost of developing a new port, and the additional cost and distance for shipping ore concentrates would exceed the cost benefits that would be generated.

Improve Loading Efficiency Using the Existing Port. TCAK recently completed a long-term plan to improve efficiency at their Red Dog Mine production facilities. Part of the loading system has been rebuilt to reduce the loss of ore concentrate as the lightering barges are loaded. No other major improvements to efficiency of the existing Portsite loader are planned or appear to be feasible. Any additional substantial production increase would require new construction on a much larger scale. TCAK has not identified any plans for large-scale construction or production increases beyond those recently achieved. Existing facilities can load the entire production, including the increased production from recent production efficiencies. A loading season with an unusual number of storms or equipment outages, however, could leave some of the concentrate in storage buildings at season's end.

Employ an Additional Lightering Barge. Adding a third self-unloading lightering barge would provide protection against loss of loading capacity from barge damage and might marginally improve hourly ore concentrate loading rates by using the loader more efficiently. This alternative is considered in detail in Section 2.3

Reduce Loading Volume. Mine-site production of metallic zinc and lead rather than ore concentrate would reduce the volume and weight of material to be loaded. Conventional smelting would not be feasible, but electrolytic processes might be feasible if electricity could be produced inexpensively and cleanly. This is not a viable alternative with existing generation capacity, but could augment production in the future if economical electrical generation could be added. This alternative is speculative and no plans are being developed for on-site production of metallic zinc or lead. This alternative is too speculative to be considered in detail at this time.

Reduce Bad-Weather Delays. The number of days ore concentrate could be loaded each year could be increased by using ice-resistant vessels to extend the loading season or by protecting the existing loader from storm waves. The most promising alternative to increase the time the existing loader could be used would be to place a breakwater seaward from the existing loader. This would allow loading to continue during all but the worst wind and wave conditions. A breakwater would not substantially reduce loading costs, but would increase safety and the likelihood that all the stored ore concentrate could be loaded each year. This alternative is considered in detail in Section 2.3.

Load Ore Concentrate Directly into Bulk Carriers at Portsite. The majority of oceangoing ships (bulk carriers) that deliver ore concentrate to smelters along the Pacific Rim require water depths of -53 feet. The Chukchi Sea offshore from Portsite reaches that depth about 3.5 miles offshore. Several sets of alternatives that might get ore concentrate to ships in more than 53 feet of water depth were examined. These alternatives can be roughly grouped as three concepts:

A shore-based loader with a dredged channel to deep water
An offshore loader without a dredged channel
A combination of offshore loader and dredged channel

Dredged Channel to Shore-based Loader. Ore concentrate could be loaded directly into bulk carrier ships from the existing near-shore loader or a similar facility if a channel was dredged from the loader to offshore water at least 53 feet deep. Constructing sections of the channel close to shore, however, would require dredging huge volumes of material. The shoreward segment of the channel also would be in a zone where large volumes of material are transported by wave and current action. Annual maintenance dredging would be required in the near-shore sections of the channel, and the channel could interfere with shoreline movement of sand and other sediment that maintain beaches north and south of Portsite. Initial and maintenance dredging costs would make this concept economically infeasible, so this alternative concept was eliminated from detailed consideration.

Offshore Loader Without Dredged Channel. If a loader could be constructed in water where the natural bottom was at least 53 feet deep (about 3.5 miles off Portsite), then no channel would be required and there would be no need for initial or maintenance dredging. Ore could be transported to the offshore loader by causeway, trestle, or tunnel. While this alternative would offer some navigation and maintenance advantages, it would be too expensive to construct for the benefits it would produce. Initial construction costs would be several times as costly as dredging a channel to deep water. This concept could not be developed under existing Federal authority and is unlikely to be constructed without Federal assistance. This alternative concept was eliminated from detailed consideration.

Combined Dredged Channel and Offshore Loader. The combination of a trestle extending from shore to a loader far enough offshore to avoid dredging in the active zone along the beach, along with a channel to deeper water, offers a balance that could minimize costs and environmental problems from building and maintaining a channel in the dynamic near-shore zone and still allow construction of an economically feasible project. Tunnel alternatives all proved to be too expensive to construct; therefore, connecting onshore facilities by tunnel to an offshore loader was eliminated from detailed consideration.

A wide range of trestle and channel alternatives was considered in the early phases of the study. The balance between dredging costs, trestle construction costs, and maintenance costs was explored in a series of increments. Those alternatives are documented in the draft feasibility report. Channel configurations were evaluated based on navigation requirements of available bulk carriers, wave and current conditions offshore from Portsite, and margins for safety defined by industry standards and by certified marine pilots operating simulators programmed to match conditions at Portsite. Detailed information about channel optimization is presented in the feasibility report and the Hydraulics Appendix to the feasibility report.

Wider channels were not considered in detail because they would require more dredging and produce more material for disposal without substantially increasing safety margins. Narrower channels would not provide enough of a safety margin. Deeper or shallower channels would not match well with the bulk carrier fleet available for shipping to the Pacific Rim. A longer channel would reach into the near-shore zone where it would intercept too much material being transported along the shore by natural processes. A significantly shorter channel would increase construction costs of the trestle sections so much that the project would be economically infeasible.

One trestle-channel alternative is carried into detailed consideration in Section 2.3. It represents a balance between initial cost and operational flexibility. Dredged material disposal sites for construction and maintenance of this alternative also are considered in detail.

2.2.4 Alternatives to Reduce Fuel Expense

High fuel transportation costs are a problem throughout Northwest Alaska. Two concepts, use of alternative fuels and offloading fuel directly from oceangoing tankers, were evaluated as ways to reduce fuel costs. The various concepts for alternative fuels and alternative fuel transfer facilities were largely developed from scoping comments and plans considered by other agencies in the region.

Alternative Energy

Coal. Immense low-sulfur coal deposits are within 100 miles of the Red Dog Mine. If this coal could be economically mined and burned as fuel, it could replace much of the diesel fuel now used to produce electricity at the mine and perhaps in some communities of Northwest Alaska. No coal is being mined in Northwest Alaska, and there are no generating facilities that can operate on coal in Northwest Alaska. Problems and difficulties of mining economically in the far north have prevented development of this alternative, and therefore, it is not considered in detail.

Natural Gas. Small amounts of natural gas have been found in rock formations near Red Dog Mine. If natural gas could be extracted economically, it could replace diesel for electrical generation and heatingTCAK has explored for natural gas in the past and is expected to continue to do so, but they have not found enough gas to make recovery worthwhile. While this alternative could be viable sometime in the future, it is not a feasible alternative at this time and prospects of it ever being feasible are uncertain. This alternative is not considered in detail

Electrical Generation by Wind. Wind-powered generators are being used in some locations along the west coast of Alaska to augment diesel-generated electricity. This option cannot provide baseload generation with present technology because winds are not consistently strong enough and because initial and operating costs are high. Information about wind generation feasibility in western Alaska is presented in the Economics Appendix of the DMT draft interim feasibility report. Wind generation will not, in the foreseeable future, replace diesel generation or reduce the need for diesel generation enough to substantially affect regional fuel needs. This alternative is not considered in detail.

Offload from Tanker Ships. Fuel for electrical generation, heat, and motor vehicles is expensive in Northwest Alaska, in part because fuel transportation is expensive. Initial bulk fuel purchase cost would drop if fuel could be delivered to the region by ship rather than by barge. Direct delivery by tanker requires both offloading and storage facilities. There are no facilities in Northwest Alaska that can unload tanker ships, and only Portsite has the tank capacity to accept a full tanker load of fuel. Developing capability to unload and store tanker loads of fuel would be uneconomical anywhere except at Portsite. Two concepts for offloading fuel from tankers were considered for Portsite: (1) construct facilities that could both load ore concentrate and unload fuel from ships; and (2) construct an offshore mooring and fuel transfer system specifically for unloading tankers without capability to load or unload other materials. The first of these alternatives is considered in detail as the Trestle-Channel alternative in Section 2.3. Several systems for offshore mooring and fuel transfer without an ore concentrate loader are described in the feasibility report. The least environmentally intrusive of these alternatives is considered in detail as part of the Breakwater and Fuel Transfer alternative in Section 2.3.

2.3 Alternatives Considered in Detail

The evaluation in section 2.2 of *alternatives initially considered* eliminated alternative port sites and alternative fuels and fuel terminals, largely because those alternatives would cost more to construct and operate than the savings or other benefits they would produce. Those alternatives could not be Federally constructed under existing authorities, and there is no strong indication that they are likely to be constructed in the foreseeable future under a new Federal authority or by a non-Federal entity.

The only concepts that could produce projects for authorization under existing Federal authorities would be the concept of providing wave protection for barges in conjunction with offshore direct transfer of fuel and the concept of providing a channel and transfer facilities for direct loading and unloading of ships. Both concepts were developed and optimized through a series of planning steps documented in the DMT draft interim feasibility report. A third alternative that would add an additional self-unloading barge to the existing operation could produce limited benefits toward meeting identified needs. This Third Barge alternative is examined in more detail although it would not be implemented under existing federal authorities.

Section 2.3 explores the three feasible concepts identified through initial evaluation of alternatives and the alternative of no change to the existing loading and fuel transportation systems (no action). The Trestle-Channel alternative is the tentatively recommended plan.

2.3.1 No-Action Alternative

Under the no-action alternative, no navigation improvements would be constructed at any of the sites considered. Efficiencies in loading ore concentrate, fuel handling, and control of contaminants associated with new facilities would not be realized. Environmental and social impacts that might be caused by construction and operation of new navigation facilities would be avoided. The no-action alternative would leave existing operations as they are now. Those existing operations are described in detail in the DMT draft interim feasibility report and appendixes for this study.

Under this alternative, the existing Portsite terminal would continue to operate using the existing two barges, barge loader, dock, and loading trestle. Barges assisted by tugs would continue to load ore concentrate at the existing facility and lighter it to ships anchored from 3 to 5 miles offshore.

2.3.2 Third Barge Alternative

A third lightering barge with one or two more assisting tugs could be added to the existing operation to increase the reliability of achieving the annual throughput goals. For ease of operation and maintenance, the new barge would be designed substantially the same as the two existing self-unloading lightering barges.

Existing operations at Portsite load up to about 1.5 million tons of ore concentrate each year. The Third Barge alternative would load the same amount of material, but would allow it to be loaded in fewer days of operation. A third barge on site also would provide a safeguard if one of the barges was damaged. Barges make about 250 trips a year to transport ore concentrate to bulk carriers offshore. The third barge alternative would require the same total number of trips, but would empty the concentrate storage buildings a little earlier in the year.

The third barge alternative is a “non-structural” alternative. It would require no major modification of the existing port facilities. It would be relatively inexpensive to implement and would add a level of assurance that concentrate shipment would be completed each year. Costs for this alternative would be about $3.7 million per year, representing initial cost of $14.7 million for a new barge and $4.5 million for a new tug, plus amortization and replacement costs during the project life. The benefit/cost ratio would be about 0.68. More information about costs and benefits associated with this alternative is presented in the DMT draft interim feasibility report and appendices to that report. That information is incorporated by reference. Section 1.2.1 identified four project purposes related to transportation needs. The potential for this alternative to meet those purposes would be as follows:

1. **Reduce ore concentrate loading costs.** This alternative would reduce potential down time from barge damage and might permit more efficient loading, which would reduce the potential for leaving ore concentrate in storage at the end of the open-water season. It would not substantially lower overall loading costs. This purpose would not be met, although the potential for losses from not loading all the concentrate would be avoided.

2. **Reduce release of ore concentrates and potential for spills of fuel and ore concentrate.** This purpose would not be met.

3. Reduce fuel transportation costs by providing facilities that can receive fuel from tanker ships. This purpose would not be met.

4. Provide flexibility for future needs. This purpose would not be met.

2.3.3 Breakwater and Fuel Transfer Alternative

This alternative would construct and operate two separate project features to more efficiently transfer ore concentrate and fuel. Ore concentrate could be loaded more days each season with a breakwater, and fuel could be transferred more efficiently from an offshore fuel transfer system. The two project features are presented as a single alternative because together they would address the most important project purposes. Either facility could be constructed separately, but presenting them together allows this alternative to be evaluated on a comparable basis with the Trestle-Channel alternative.

The Breakwater Component. Loading all the ore from the Portsite concentrate storage buildings into the bulk carriers offshore is a race against the weather and ice each year. Every year so far, the DMT operators at Portsite have succeeded in loading all the concentrate. The data show that in 2000, a fairly moderate year for weather conditions, wave conditions or adverse currents, halted loading about 25 percent of the potential loading season (DMT draft interim feasibility report, appendix E). This was not an exceptional year, but about 32 days of potential loading time were lost. Barges can operate safely in waves of up to about 6.5 feet, but are unable to dock safely for loading when waves are higher than about 3 feet, so a 3-foot wave environment stops concentrate loading. Weather data summarized in the Hydraulics Appendix to the draft interim feasibility report also shows that about 75 percent of the loading time lost in 2000 was in 3 to 6.5-foot waves. If wave height could have been reduced to 3 feet or less at the loading face, then about 11 or 12 days more loading time would have been available. That additional time was not needed in 2000, but historical wave data and hindcast models of associated waves indicate that during some years in the fairly recent past, waves would have halted loading for long enough so that some of the concentrate would not have been loaded in those years.

A breakwater or some other form of wave barrier could reduce wave height at the existing dock face so that barges could be loaded almost anytime waves offshore from Portsite were less than 6.5 feet. It also would reduce damage to the barges during loading operations and would reduce risk to the people working there. An economically feasible sheet-pile wave barrier would not stand up to ice conditions, so this alternative would be feasible only with a breakwater. A conventional rubblemound breakwater would be the most feasible breakwater to build and maintain.

The breakwater would be a 2,800-foot straight rubblemound breakwater parallel to shore about 695 feet seaward of the third sheet-pile cell of the existing loading facility (figure 2-4). It would create a protected barge maneuvering area between the breakwater and the barge loader. The breakwater would be constructed at a depth of about -24 feet MLLW. The top would be about 10 feet above MLLW with a crest 18 feet wide with side slopes 1 vertical to 2 horizontal. The base would be about 200 feet wide and would cover about 13 acres of sea bottom. The breakwater would be constructed of 10-ton armor rock overlying quarry rock and bedding stone layers.

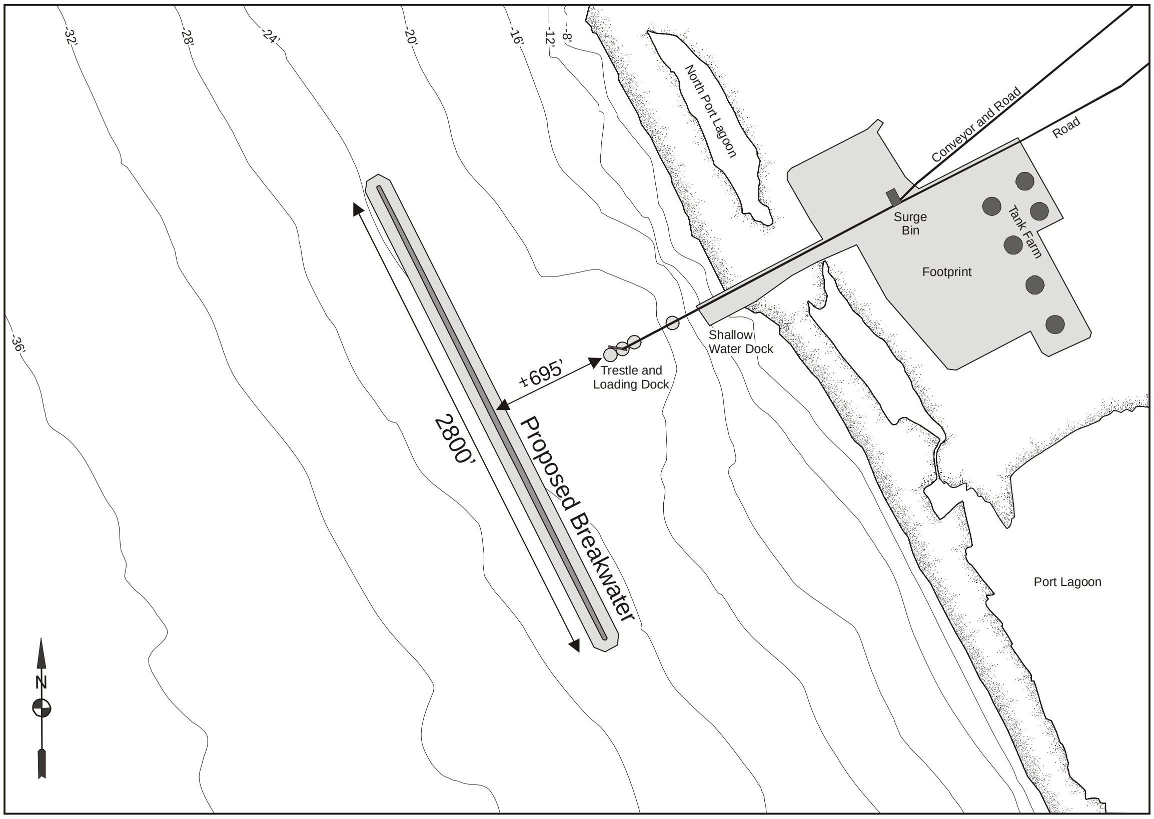

Figure 2-4. Portsite breakwater component of the Breakwater-Fuel Transfer alternative.

The contractor would be expected to construct the breakwater by working from barges supported by tugs and smaller vessels. The contractor would probably work almost continuously through three open-water seasons to construct the breakwater. Rock for the breakwater would come from the Nome quarry or from some other existing, developed material source.

Drifting sand and other sediment would collect at the breakwater after construction and would reduce the depth between the breakwater and the existing loading facility. The deposited material would be dredged as required to about –17 feet MLLW and redeposited down current to prevent depletion of the beach to the south and to prevent shoaling in the turning basin. Hydrologists estimate that sediment accumulation would average about 26,000 cubic yards (yd^3) per year, which indicates that dredging might be required every few years depending upon storm severity and other forces that move the bottom material.

Fuel Transfer Component. This part of the Breakwater-Fuel Transfer alternative would construct and operate a new onshore pumping station and a pipeline from the pumping station to a mooring area about 10,000 feet offshore in water at least 43 feet deep MLLW for ocean going tankers. The 20-inch-diameter, ¼-inch-thick steel pipeline would be in a horizontal, directionally-drilled tunnel for the first 2,500 feet to minimize beach disturbance and effects on the lagoon just shoreward of the beach. It would be buried in a cut-and-cover trench for the remaining distance to the offshore terminal. Tankers bringing fuel to Portsite would tie off to mooring buoys, raise a flexible pipe from the bottom, and connect it to the ship's fuel discharge manifold. The fuel would then be pumped to the Portsite DMT fuel storage tanks. When the tanker was unloaded, the ship would return the flexible pipe to the ocean floor. At the end of each season, a mechanical device called a "pig" would be used to clean the pipe before it was filled with inert gas. This would prevent fuel spills if the pipeline or the fuel line were ruptured during the off-season. The flexible pipe and buoys also would be removed at the end of each shipping season and reinstalled at the beginning of the next shipping season. Figure 2-5 shows the approximate alignment to reach deep water in the shortest distance and a general layout for this alternative feature.

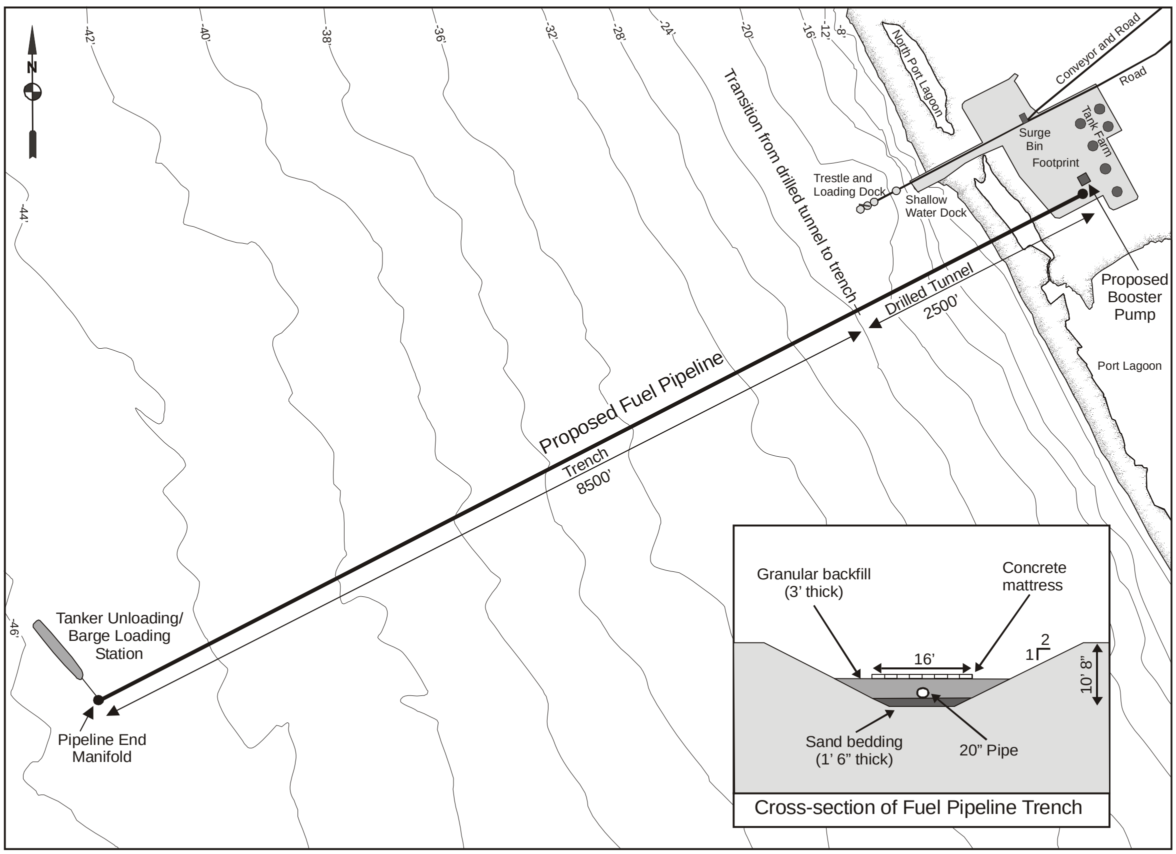

Figure 2-5. Pipeline and trench for the Fuel Transfer alternative at Portsite.

Several options would be possible for mooring ships and transferring fuel at the seaward end of the 11,000-foot pipeline (more detail is in the draft interim feasibility report). The least expensive facility would use a multi-buoy mooring (MBM) system (figure 2-6). The MBM consists of six fixed anchors in addition to the port and starboard anchors on the ship to moor the tankers. A pipeline end manifold (PLEM) would be positioned on the sea bottom and a flexible fuel line connected to the PLEM would be raised from and returned to the sea bottom after each use. This design could off-load from a foreign-flag tanker of typical capacity: about 55,000 deadweight short tons, about 650 feet long, 107 feet wide, and drawing about 40 feet of water fully loaded. About four tanker deliveries per year could unload about 50 million U.S. gallons of fuel to supply Portsite, Red Dog Mine, and most of the communities of Northwest Alaska. The existing fuel barge facility would be used to transship fuel into 5-million-gallon or smaller barges for delivery to communities in Northwest Alaska.

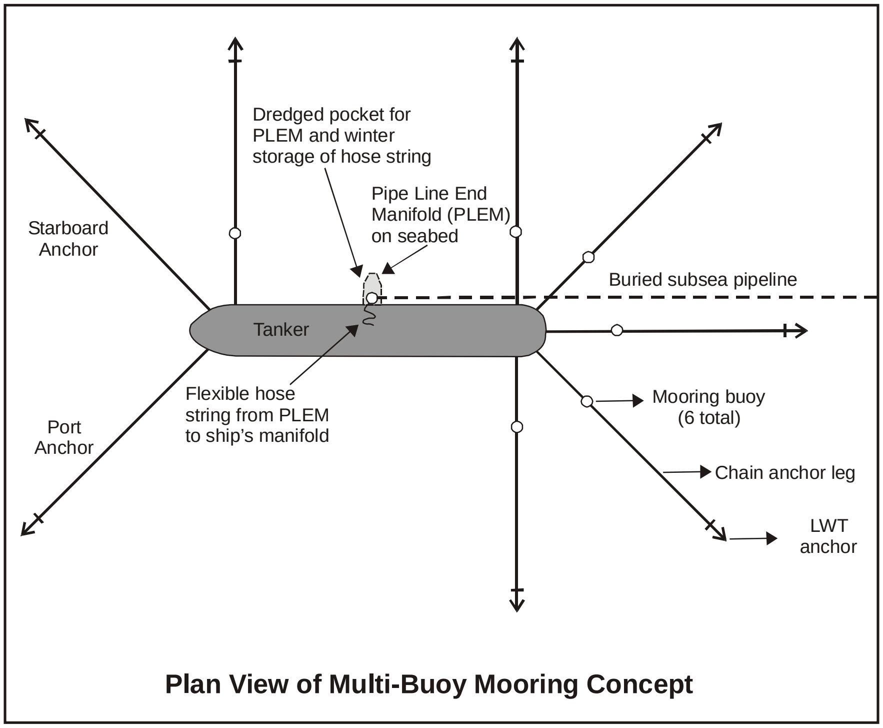

Figure 2-6. The multi-buoy mooring (MBM) concept plan view.

Tanker moorings of this type are relatively common and are used at exposed ocean terminals near Los Angeles, California, and Barber's Point, Hawaii. Other terminal mooring and fuel options would involve similar systems to moor ships and transfer fuel to the pipeline to shore.

Initial breakwater cost is estimated at $69.4 million with annual maintenance costs of about $425,000. The fuel transfer component first cost would be about $77.2 million, with annual maintenance and operating costs of about $4.2 million. The total average annual costs for this alternative would be about $13.5 million per year, including the 50-year amortized cost of construction and annual costs of maintenance. The benefit-cost ratio would be about 1.16. More information about costs and benefits of this alternative is presented in the DMT draft interim feasibility report and appendices to that report. Section 1.2.1 identified four transportation needs related to project purpose. The potential for this alternative to meet those needs would be as follows:

1. Reduce ore concentrate loading costs. The breakwater and fuel transfer alternative would permit more efficient loading, which would reduce the potential for leaving ore concentrate in storage at the end of the open-water season. It would not substantially lower overall loading costs. This purpose would not be met.

2. Reduce release of ore concentrates and potential for spills of fuel and ore concentrate. The fuel transfer component would substantially reduce the potential for spills during fuel transfer. The breakwater would reduce the potential for accidents to barges or tugs that would spill fuel or ore concentrate, but would not reduce losses during the offshore transfer of ore concentrate. This purpose would be partially met by reducing the potential for fuel spills and barge damage.

3. Reduce fuel transportation costs by providing facilities that can receive fuel from tanker ships. This purpose would be met by allowing fuel transfer directly from tankers.

4. Provide flexibility for future needs. This purpose would be partially met by providing greater flexibility for fuel handling. It might not adapt well for additional ore concentrate throughput or changes in products being exported.

2.3.4 Trestle-Channel Alternative

Evaluation of problems and needs showed that loading ore concentrate directly onto ships could offer substantial benefits. A number of direct loading alternatives were considered, but all would require a channel to allow ships to come inshore from deep water, and all would require an elevated loading platform that would house conveyors, loaders, and other equipment and that would provide working space for operations. The loading platform deck would be about 300 feet long and 90 feet wide and would be about 40 feet above MLLW. The seaward end of the loader would have to be a minimum of about 1,700 feet from shore to keep the channel to deep water far enough offshore to avoid the active zone where sediment movement is greatest. It should not be much farther offshore, however, because the costs of connecting the platform to shore would be expensive and because moving the platform farther offshore might increase environmental effects.

Various channel depths and distances offshore for loading platform placement were examined during the course of this study. They are presented in Section 4 of the DMT draft interim feasibility report and in appendices to that report. Those documents also present information about several alternatives, each with many variations, for connecting the loading platform to facilities on shore. The major options are discussed earlier in this section (Alternatives Initially Considered). The Trestle-Channel alternative selected for detailed consideration and identified as the tentatively recommended plan would avoid environmental problems associated with a solid-fill causeway, but could be constructed with technology and materials that have been proven in the Arctic environment. Figure 2-7 shows the alignment of the trestle and loading platform for the Trestle-Channel alternative associated with the tentatively recommended plan.

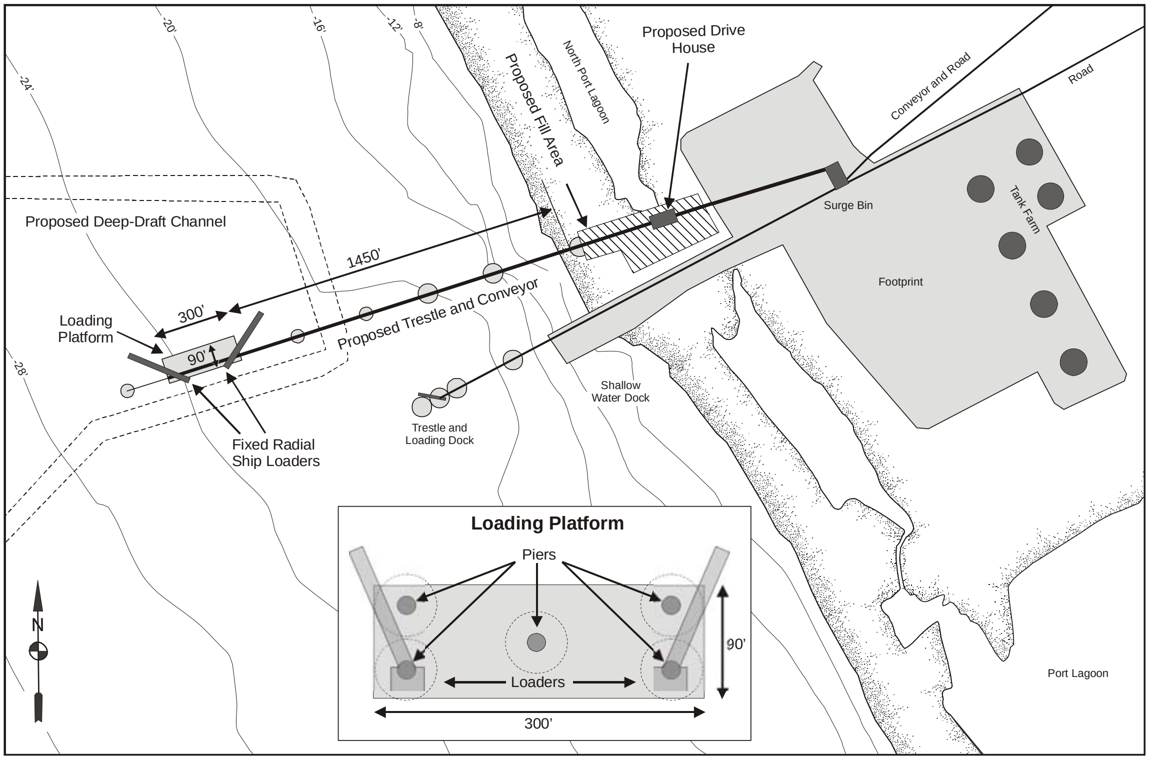

Figure 2-7. Trestle and loading platform alignment and layout, Trestle-Channel alternative.

Loading Platform. The loading platform would function as a multipurpose platform for loading ore concentrate directly into bulk carriers and unloading fuel, cargo, and supplies for mining operations. Major components of the platform would be: (1) five piling clusters, (2) a 90-by 300-foot deck, (3) a pair of movable loaders, and (4) a mooring dolphin and catwalk seaward of the loading platform. The loaders would swing, extend, and contract to load up to 2,600 tons per hour of ore concentrate in the holds of receiving ships. Figure 2-7 shows the general dimensions and layout of the loading platform that could be constructed for this alternative.

The loading platform would include a manifold and pumps to connect a fuel line with ocean-going tankers. Fuel from the tankers would be pumped from tankers moored next to the platform dock and transferred to onshore tanks. The system would be capable of pumping up to 4,000 gallons per minute. The platform also would be capable of handling limited volumes of general cargo in units as large as 40-foot containers weighing as much as 25 tons.

The platform could be constructed on site, but would more likely be constructed in an out-of-state shipyard and towed to the site, where it would be jacked up and supported by pilings driven beneath it. The type of piling to be used would be selected by the contactor, based on their experience and the construction methods they use. Piling clusters would likely include one king pile surrounded by six supporting piles. There would be seven clusters supporting the trestle and dock, and one cluster as a marine dolphin seaward of the dock. The 36-inch-diameter king pile would be set in a hole bored into bedrock, while the supporting piles would be driven to bedrock. Cuttings from the king-pile boring would be side-cast on site. Heavier components of the cuttings would remain next to the hole, while the finer sediments would spread in a thin layer around and down current from the borings. On average, approximately 30 cubic yards of cuttings would be generated by the installation of each piling cluster (total of about 240 cubic yards). The entire pile structure would be filled with concrete to provide impact and buckling resistance. The pilings would be constructed specifically to withstand Chukchi Sea ice loads.

The piling clusters would cover a total area of about 0.1 acre of bottom. Some construction methods could remove material from inside the pilings before they were filled with concrete. Material removed would not contain cuttings, drilling mud, or other introduced material. Figure 2-8 shows a typical piling cluster layout that might be used. The contractor might choose to use a different type of piling system, but the areas affected and the general layout would be similar. Any piling alternative would anchor individual or clusters of pilings into the sea floor to support the loading platform.

Two ballast-filled, sheet-pile cells 72 feet in diameter would support the trestle over water between the shore and the pile clusters. The cells would be constructed during late winter by driving the sheet piling to bedrock from an ice pad. The material in the cells would be compacted by vibration. Additional ballast materials would be added from commercial quarries as necessary.

The draft interim feasibility report discusses options that might be employed. The loading platform would be constructed or positioned during one or more open-water seasons, and the pilings for both the platform and the mooring dolphin would be driven or placed during a single season. Construction would begin after the Bering Strait opened in late spring or early summer and would continue through the open-water season. Placing or constructing the platform, driving the pilings, and support for construction activities would be accompanied by ship, tug and boat activity, general construction activity on the platform, and the noise of pile driving and steel work.

The deck of the completed loading platform would be about 40 feet above MLLW. The highest parts of the main structure would be 142 feet above MLLW. The total surface area of the loading platform would be about 0.6 acre.

Trestle. The loading platform would be connected to shore by a 1,450-foot, bridge-like trestle that would support the ore concentrate conveyor, fuel transfer line, electrical power, communication lines, a single-lane road, and other equipment and utilities connecting the platform with onshore facilities.

The trestle would be about 35 feet above the water. It would be constructed adjacent to and just north of the existing barge loader and trestle. It would be constructed on five spans of a through-truss bridge (figure 2-8). The trestle would be about 30 feet high (distance from underside to top of the structure) and about 20 feet wide. This would provide an 18-foot-wide by 22-foot-high passage for trucks and equipment.

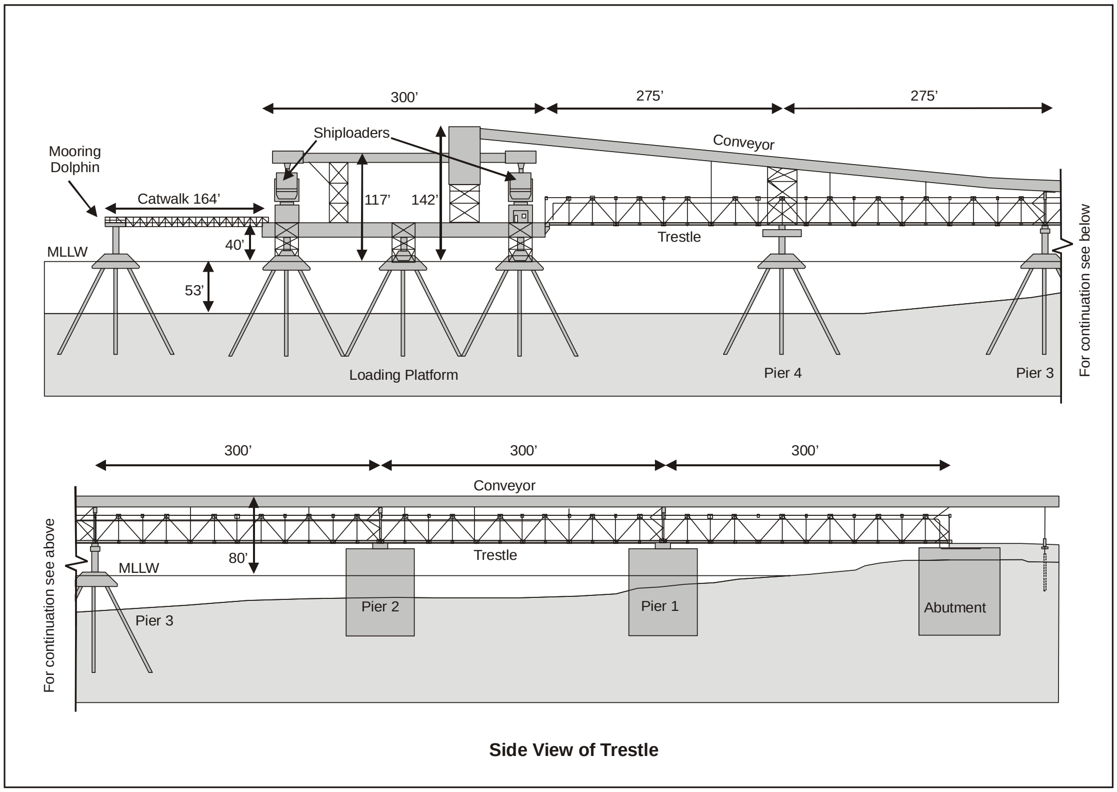

Figure 2-8. Side view of the trestle, platform, and supports, Trestle-Channel alternative.

The first three trestle spans from shore would be about 300 feet long, and the fourth and fifth spans 275 feet long. The gallery for the concentrate conveyor would be above the roadway. The conveyor gallery would be completely enclosed and would include a dust suppression vacuum system with pick-up points for a vacuum truck.

The abutment on shore would be set back to about +12 feet MLLW to avoid affecting sediment transport along the beach. The first two trestle foundations would be 74-foot-diameter sheet-pile cells with a footprint of about 4,300 square feet or 0.1 acre each. The other marine foundations would be pilings like those used to support the loading platform. The contractor could be given the option of selecting another foundation type for the trestle, but areas affected and construction would be similar.

Channel and Turning Basin. The turning and mooring areas at the loading platform and the channel to deep water would be dredged to a design depth of –53 feet MLLW. This depth would allow safe passage of 45-foot-draft bulk cargo vessels that typically transport ore concentrate in the world market (additional design vessel information is presented in the draft interim feasibility report). The channel would extend about 3.5 miles from the dock to deep water in the Chukchi Sea. It would be about 250 feet wide across the bottom at its seaward end in water (about –53 MLLW) and would gradually widen to a bottom width of 760 feet at the east (shoreward) end where it would provide a turning basin and a berthing area by the loading platform. The turning basin would allow fully loaded fuel tankers and Panamax bulk carriers to approach the dock and turn to dock with the bow seaward. Figure 2-9 shows the dimensions planned for the channel.

More detailed information and information about a variety of other channel depths that were considered initially is presented in the DMT draft interim feasibility report.

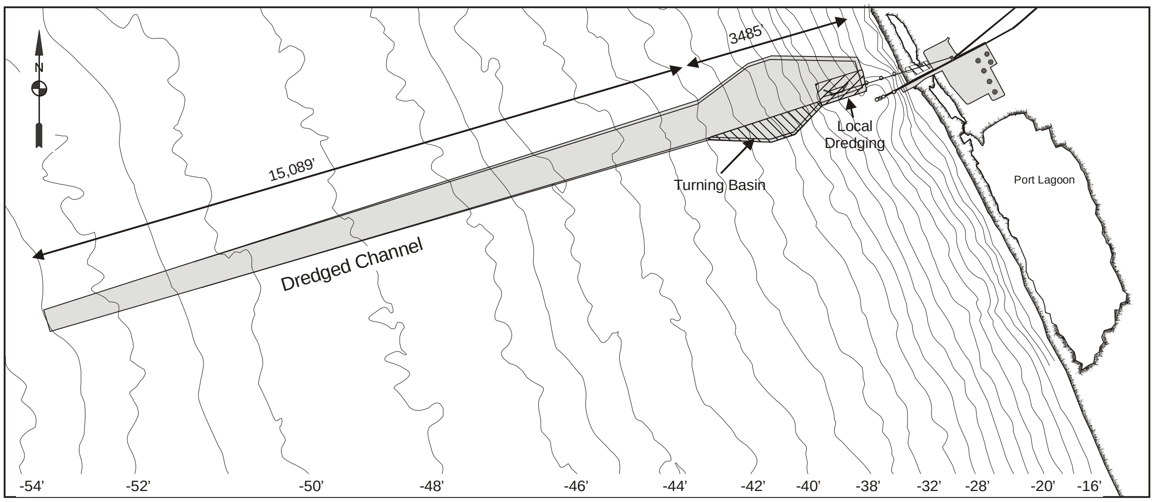

Figure 2-9. Channel dimensions, Trestle-Channel alternative

The channel would be dredged with a side slope of 1 vertical to 3 horizontal during project construction. This is the same slope as the 4 vertical to 12 horizontal ratio pitched roof commonly used in home construction. The material in the side slopes of the channel alignment is of various grain sizes and would be likely to slump into the dredged channel for several years after it was dredged. The channel side slopes would be expected to eventually slump to a stable 1 vertical to 10 horizontal slope. This is a gentler slope than a standard handicap access ramp commonly constructed for public buildings. This initial slumping would be accommodated by initially over-dredging the channel so it would be deeper than –53 feet MLLW. Over-dredging to allow for the side slopes to slump is a common practice to ensure new channels will remain navigable. Over-dredging during initial construction to ensure navigability sometimes is referred to as “required over-depth dredging for efficient maintenance (RODFEM).” Final slope is achieved by natural slumping rather than by dredging a 1 to 10 slope because dredging a smooth final slope at 1 to 10 is difficult and because the amount of slumping would vary along the channel due to differences in bottom material.

The total sea bottom disturbed by dredging to the design depth, including the 1V:3H slopes, would be about 330 acres. Over-depth dredging to allow for slumping would add about 8 more acres to the area affected. If all the slopes lay back to the 1 vertical to 10 horizontal slope, a total of about 430 acres would be affected. Altogether, about 8.1 million yd^3 would be dredged during project construction. That would include about 6.2 million yd^3 dredged to take the channel and turning basin to –53 feet MLLW (and allowing for an additional foot of over-dredging by the contractor). Another 1.9 million yd^3 would be dredged for RODFEM to make the channel deeper than the –53-foot design depth so that it would still function at design depth after the side slopes slump and sediment are deposited.

Dredging would require work for three open-water seasons (approximately July through October each year).

Contractors generally are allowed to select the dredging method that they believe would be most efficient and that best suits their capabilities, but site conditions indicate that hopper dredges would be best adapted to removing the main volume of dredged material. Clamshell dredges or some other alternative might be used to work in corners and other more confined areas.

Maintenance Dredging. Over-dredging during project construction would create sumps 2 to 5 feet deep beneath the channel, turning basin, and berthing areas. Those sumps would gradually fill in as the side slopes slumped and as sediment was deposited. That deposited material would be periodically dredged to re-establish the over-dredged depths. As in the initial construction dredging, the contractor would be allowed to select the method best suited for the maintenance dredging requirements.

Hydrologists estimate that slumping of side slopes and deposition of sediment would fill enough of the over-dredged channel and turning basin so that first maintenance dredging would be required about 5 years after construction was completed. They estimate the following maintenance dredging would be required over the 50-year economic life of the project:

Years After Construction	Dredge Quantity (yd^3)
5	1,100,000
17	1,187,000
33	1,196,000
49	1,196,000

The deeper water of the turning basin and mooring area would reduce wave action on the beach and near-shore intertidal zone at the project, causing material moving along the beach to accumulate shoreward of the turning basin. This natural movement, termed littoral drift, is driven by waves, and particularly by the larger waves associated with storms and strong onshore winds. This process carries sand and gravel southward along the beach. Hydrologists (Hydrology Appendix of the draft FS) estimate that about 26,000 yd^3 of beach material would accumulate annually shoreward of the turning basin. This material would be mechanically removed and redeposited in the near-shore zone south of the project each year. This would prevent beach starvation and erosion south of the project and would help prevent material from eventually building up in the turning basin. A small dredge left at the site and operated for about a week each year would serve this purpose.

Dredged Material Disposal.

Disposal Alternatives Initially Considered. The following annotated list identifies dredged material disposal options that were considered during planning and why they were eliminated from consideration or carried forward for detailed consideration.

- Sort dredged material and use it beneficially for mitigation or construction: Dredged material clumps could be broken apart mechanically or hydraulically and sorted to yield material of different sizes that could be used for construction associated with DMTS or for other regional construction projects. Dredged material could be sorted in the marine environment or on land. Both options were deemed infeasible for environmental and cost reasons. Sorting the material in the marine environment would produce a dense cloud of fine material in the upper water column. Table 3-22 in Section 3.4.6.4 shows that bottom material in the turning basin and channel could be expected to contain 39 to 81 percent silt and fine sand. This alternative would reduce the volume of material disposed of into a disposal site, but would not eliminate the need for an ocean disposal site. The fine material, enough to cover 1,000 acres 2 to 4 feet deep, would be released into the water column in a continuous stream as it was washed from the gravel and coarser sands and diluted with seawater. This would have a far greater impact on turbidity and cause much more deposition down current than disposal of dredged material from a hopper or barge.

The 3 to 4 million cubic yards of gravel and coarser sand recovered in this process would require on-land storage until construction, which would create a storage pile equivalent to 100 acres 20 to 40 feet deep that would leach salt onto the tundra beneath and around it. Detailed costs for this alternative were not computed, but initial evaluation showed that it would more than double dredging costs.

Transporting dredged material to land and then recovering gravel and coarse sand would cause similar problems. Storing the recovered material would cover and salt the storage site, and there would still be 3 to 4 million cubic yards of fine material that would require disposal. That material could be placed in an upland site or in an ocean disposal site. Those options are also explored in this section. Storing, washing, and handling the dredged material would require large volumes of water, would affect hundreds of acres of tundra, and would more than double dredging costs.

The alternative of sorting dredged material to recover gravel and coarse sand for construction was eliminated from detailed consideration on the basis of environmental damage and unfeasibly high costs.

- Use unsorted material to backfill Red Dog Mine or borrow areas: Dredged material could be dewatered at the coast and trucked to borrow pits along the DMTS road or to the Red Dog Mine. The volume of dredged material (about 5,000 acre-feet) would cover as much as a square mile of terrestrial habitat at the dewatering site, and runoff from the site could adversely affect a much larger area. Dewatering would be necessary because saltwater in the dredged material would be harmful to streams and vegetation down slope from any disposal site. Even after dewatering, salt still would leach out of the dredged material if it was placed on land. Moving the dredged material to Red Dog Mine for later reclamation would require roughly 80,000 truck trips if each load was 100 cubic yards. Backhauling it in the existing ore concentrate trucks would take more than 7 years, and the unconsolidated dredged material would have to be stored on the tundra until it could be moved, then stored again at the mine for 30 years or more until mining was completed. The entire upland area around Portsite is underlain with permafrost, and material being stored for transport to the mine would freeze permanently into the permafrost beneath it if left for more than one season. Removing that frozen material for transportation to a disposal site would be difficult, expensive, and destructive to the environment. Both storage sites would require hundreds of acres with loss of habitat under the storage areas, material carried off-site by wind and water, and salt leaching into surrounding lands.

None of the sites disturbed by mining or other development along the DMTS corridor is large enough to accept the volume of material that would be dredged and still allow mining operations to continue. Part of the dredged material could be used to backfill borrow areas, but it would be a source of salt and fine material that would disperse into the surrounding lands and revegetation would be slow. The remainder would require marine or on-land disposal.

Using unsorted dredged material to backfill barrow or mine sites would be environmentally unacceptable and prohibitively expensive. This disposal alternative was eliminated from detailed consideration.

- Place dredged material in an on-land disposal area: A large containment structure could be constructed on land to hold all the dredged material. If it was 20 feet high, then it would have to enclose about 300 acres to contain all the material if all the water in the dredged material was separated out. The material would be slow to revegetate and initially would have little habitat value for most species of the area. Runoff and dust from the disposal site would impact the surrounding tundra for miles. On-land disposal of dredged material works best with a hydraulic dredge, but a hydraulic dredge could not work effectively in the bottom conditions at Portsite. A clamshell or hopper dredge probably would be required to cut a channel into the firmly packed bottom material off Portsite. On-land disposal would require the material to be loaded into a barge, transferred to the existing dock or other offloading system, transferred into trucks, and then hauled to the on-land disposal site. This would be expensive and would require multiple handling that would inevitably allow material and seawater to escape. It also would present the same problems with multiple handling as the alternative of using it to backfill barrow areas or the mine.

This disposal alternative was eliminated from detailed consideration because it was environmentally unacceptable and too costly to be feasible.

- Place dredged material in a coastal lagoon: The big lagoon just south of Portsite could contain more than half the dredged material. The remaining material could be placed in nearby smaller lagoons. This alternative could stabilize the coastline near Portsite and could produce usable land for development.

Using lagoons for dredged material disposal was not considered in detail because it would cause unacceptable impacts to an ecological system that is locally common, but globally relatively uncommon.

- Place dredged material in an ocean disposal site: Ocean disposal is an economically viable alternative that would be compatible with dredging methodology best suited for the Trestle-Channel alternative. Alternatives for ocean disposal are considered in detail.

Disposal Alternatives Considered in Detail. Appendix 2 is a draft Dredged Material Disposal Site Study (DMDSS) evaluation of ocean disposal sites that might be used for material from construction and initial maintenance dredging for the Trestle-Channel alternative. The evaluation is based on criteria developed for the Marine Protection, Research, and Sanctuaries

Act. The evaluation defined a zone of siting feasibility off the coast of Portsite and applied the evaluation criteria of 40 CFR 228 to determine suitability of feasible sites. The following siting considerations were of particular importance in that evaluation:

- The closest existing designated ocean disposal site is more than 100 miles away near Nome. That site is too distant to be an economically feasible disposal alternative for a project at Portsite.

- Any ocean disposal site should be in deep enough water to ensure that material disposed of would not be redistributed into the dredged project features, the surrounding sea bottom, or into near-shore sediment processes that might alter beach and near-shore subtidal bottom characteristics. Evaluation of waves, currents, and other oceanographic processes in the southeastern Chukchi Sea indicated that minimum depth should be more than 50 feet below mean seal level. Navigation considerations indicated that any disposal site should be in water at least 60 feet deep so that the material disposed of would not affect coastal shipping or require marking and charting to protect ships.

- The Chukchi Sea offshore from Rabbit Creek, south of Portsite (figure 2-11) is considered by local hunters to be a particularly good place for seal hunting. A number of those hunters in meetings and conversations reported this and many expressed the belief that seals were attracted to the area by better feeding. Test fishing by the Bering Sea Fisherman's association also found more king crabs there then in other sites in the general Portsite area. Based on the informed opinions of the people who hunt and know the area, the sea bottom off Rabbit Creek was avoided in site selection.

- Sea mammal hunters from the area hunt all along the southeastern Chukchi Sea coast, but are likely to hunt most intensively in areas near their communities. Hunters from Kivalina, 17 miles north of Portsite (figure 2-11) have identified the area around their community, including the offshore waters, as being of particular importance. This also is documented by the "no-fly" zone that they established with NOAA marine mammal researchers (figure 3-34 in Section 3 shows this zone in connection with marine mammal surveys). Site selection minimized intrusion into this area.

Bowhead whale hunters from northwestern and northern Alaska are concerned that offshore spring bowhead migration could be affected by dredged material placement and have indicated that they would prefer placement as close to shore as is feasible to avoid effects to the main spring migration.

Sites considered are 5,600-acre rectangular areas about 2 miles wide by about 4.3 miles long offshore (west) of Portsite. Initial dredging would produce enough material to cover the 5,600-acre site to a depth of a little more than 1 foot if the material was distributed equally over the site. Figure 2-10 shows the dimensions of the tentatively recommended disposal site. The Corps tentatively recommended plan would place the material dredged from the channel, turning basin, and berthing areas during construction in that disposal site offshore from the project. The bottom in the area ranges from -62 to -72 feet MLLW. The site is deep enough and far enough offshore to ensure that materials disposed of would not adversely affect navigation or coastal hydraulics.

Appendix 2 evaluates disposal siting alternatives, dredged disposal activities, and environmental effects of disposing material offshore. Other sites considered in Appendix 2 are shown in figure 2-11. Appendix 2 compares the sites and indicates that bottom conditions are similar in all the sites and are compatible with the material that would be dredged. Site 2, the tentatively recommended disposal site keeps the disposal site as close as is feasible to existing development and to the other components of the tentatively recommended plan. It also minimizes project intrusion into migratory pathways farther off shore used by bowhead and beluga whales and by walrus and seals.

Material dredged to maintain the channel would be placed in the offshore disposal site unless it could be used beneficially for construction or environmental restoration or could be disposed of in a site that would cause less environmental impact. Potential disposal sites and the most recent ocean disposal site monitoring results would be evaluated before each maintenance dredging event.

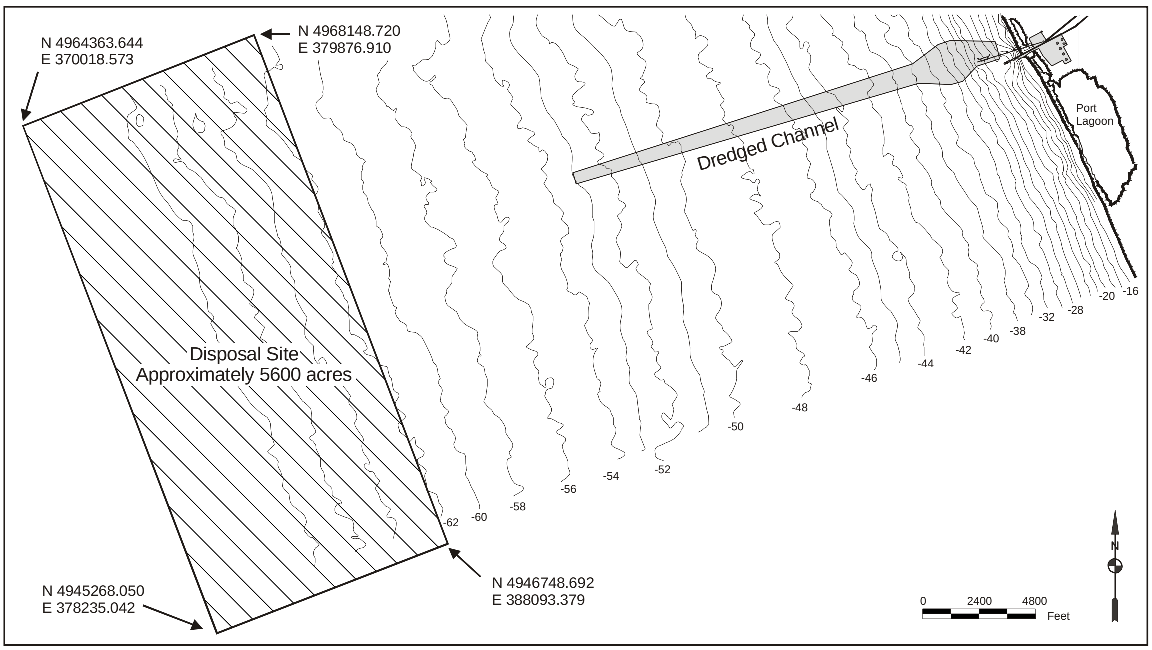

Figure 2.10. Dimensions of an offshore disposal alternative at Portsite.

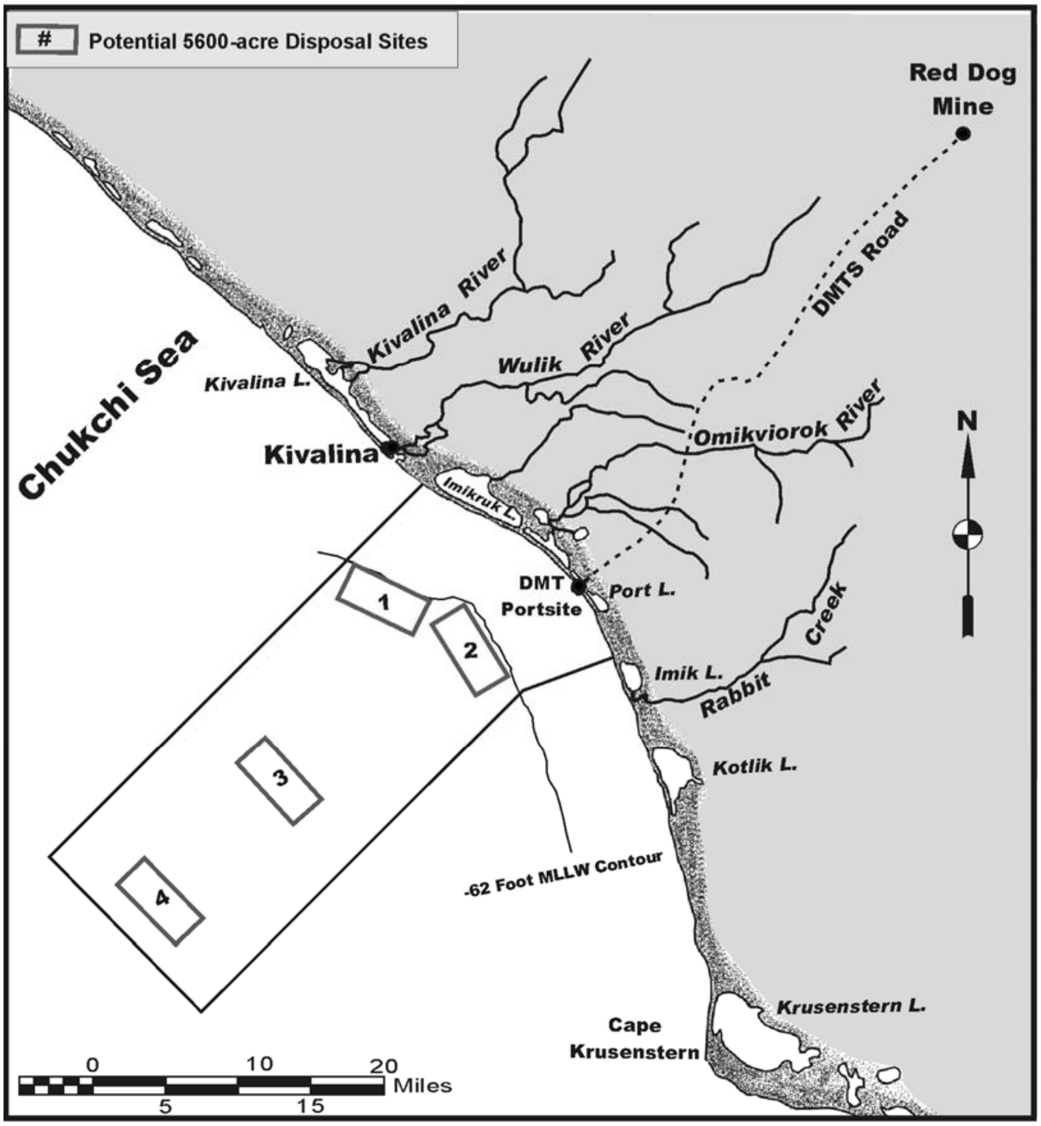

Figure 2.11. Ocean Disposal Sites Considered.

Other Project Features. Onshore loading facilities would be modified or expanded to make the project work. The existing loading dock would remain in use to serve barges delivering supplies, as a tug berth, and as a work site for spill response and other needs. The conveyor system would be modified or rebuilt for the new alignment to the trestle and would be equipped with better dust containment features. A small area (about 2.5 acres) would be filled for the realigned conveyor and the approach and abutment for the trestle. An additional acre would be filled for another fuel storage tank to store gasoline for regional distribution. A new diesel generator would be added, one or more existing generators might be removed or replaced, and the existing generation building would be modified and expanded to accommodate the additional power generation.

Project Construction. Main project features, including the channel and other dredged areas, the trestle, and the loading platform could be constructed in three construction seasons. Engineers estimate the project could be in operation 4 years after the beginning of the first full construction season.

Limited on-land construction might be possible during the winter. With one exception, all work in the Chukchi Sea would be accomplished during the open-water season. The only exception would be construction of the near-shore pilings for the trestle, which would be placed through the ice. Previous experience shows that setting sheetpile cells in the open-water season is difficult and uncertain in the wave environment. Construction work above the sea on the trestle and loading platform could continue into the winter, but could be restricted to avoid primary marine mammal hunting periods.

Project Operation. The completed project would load the same number of bulk freighters each year as are loaded now and would offload fuel from four or five tankers per year. The existing operation off-loads fuel from four or five ocean-going barges each year, so the total number of deliveries would be about the same. The shipping season would be the same as now, beginning soon after ice is out of the Bering Strait and after the bowhead migration is through. Loading would be completed earlier than with present operations because ships could be loaded faster and weather would prevent loading less often. Ships could be docked anytime waves were less than about 6.5 feet and winds were 20 knots or less. Ships could remain at the dock and continue loading or unloading with 6.5-foot waves and sustained wind speeds of up to 30 knots.

After construction, shipping and loading operations would be much quieter than now. Ships waiting to be loaded would wait in the same mooring areas, but instead of 250 barge trips and about 1,500 hours of operation by four tugs, ships would be assisted to the mooring berth by two tugs and after loading would be assisted back out to sea by two tugs. Compared with the existing conditions, the hours of tug operation with the project would be significantly reduced.

Project Cost and Benefits. Dredging the Federal channel and turning basin would cost an estimated $75 million dollars, with annual maintenance costs estimated at $1,245,000. Costs would be shared between the Federal government and the non-Federal sponsor. The non-Federal sponsor would pay all costs of constructing, maintaining, and operating "local service facilities," which include the trestle, loading platform, alterations to the conveyor and utilities systems, an additional 1.5 million-gallon fuel storage tank, and other on-land project features. Total estimated cost for local service facilities is about $155.5 million with annual operation and maintenance costs of about $6.550 million.

The benefit-cost ratio for this alternative would be about 1.2. Additional information about costs and benefits associated with this alternative are presented in Section 4 of the DMT draft interim feasibility report. That information is incorporated by reference.

Section 1.2.1 of this DMT draft EIS identified four transportation needs related to project purpose. The potential for this alternative to meet those needs would be as follows:

1. **Reduce ore concentrate loading costs.** This alternative would permit more efficient loading, which would reduce potential for leaving ore concentrate in storage at the end of

the open-water season. It also would lower overall ore concentrate loading and fuel purchase costs. This purpose would be met.

2. Reduce release of ore concentrates and potential for spills of fuel and ore concentrate. This alternative would substantially reduce the potential for spills during fuel transfer. It also would reduce the potential for accidents to barges or tugs that would spill fuel or ore concentrate and would reduce loss of ore concentrate by eliminating the double transfer of ore concentrate. This purpose would be met.

3. Reduce fuel transportation costs by providing facilities that can receive fuel from tanker ships. This purpose would be met by allowing fuel transfer directly from tankers and by providing facilities that could readily load coastal barges for regional bulk delivery.

4. Provide flexibility for future needs. This purpose would be partially met by providing greater flexibility for fuel and ore handling. Additional development would be required to substantially increase loading of mine products, but new transportation facilities would be unlikely to make this alternative obsolete in the foreseeable future.

2.4 Potential Mitigation Measures

Concerns raised during scoping and in coordination with agencies, tribal councils, and other stakeholders were used during analysis of potential impacts of project construction, operation, and maintenance to identify measures that might avoid or reduce project impacts. This section identifies those suggested measures. The notes following each potential measure identify why the measure might work to avoid or minimize impacts. The final decision about all project elements, including mitigation measures, will be made by the Federal decision maker at the end of the planning process and will consider comments received during public review. The tentatively recommended plan identified in Section 2.3 includes mitigation measures initially identified as part of the draft proposed action. Mitigation measures could be added to or removed from the proposed action after public review of the EIS.

The following is an annotated list of mitigation alternatives that were considered for implementation for alternatives considered in detail. Implementation for the No Action and Third Barge alternatives would not require mitigation within the scope of this draft EIS because they are not Federal actions. Corps guidance encourages incremental analysis of mitigation measures when feasible, so the notes include an evaluation of whether the measure could be implemented with lesser or greater increments of mitigation.

Establish timing windows to avoid work 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, but costs are not quantifiable with available information. *Incremental evaluation*: Marine mammal hunting ends when the Arctic ice pack recedes, which varies in timing from year to year. This prevents meaningful incremental analysis of allowing construction before June 30. Ice often is present until June 30 or later. Contractors might not benefit much from beginning construction earlier than June 30 if ice was still present. Additionally, the cost to the project in local goodwill that would result from not avoiding work during the period when the majority of marine mammals in the area are harvested for food would far outweigh any foreseeable benefits. *Recommendation:* Tentatively recommended in the draft EIS for all Federal actions.

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: about $100,000 per year for 5 years. *Incremental evaluation*: Evaluation for a shorter period would not offer any certainty that observed effects were from the project rather than natural conditions. The monitoring period could be extended if results were inconclusive. Review of past data indicate that natural variability in pack ice movement and marine mammal distribution are too great to allow discrimination between project effects and natural variation with a monitoring period of less than 5 years. *Recommendation:* Tentatively recommended in the draft EIS for the Breakwater-Fuel Transfer and Trestle Channel alternatives.

Install a seasonal observation post on any new loader to assist marine mammal hunters. The loader 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. Cost to the project sponsor: unknown. *Incremental evaluation*: No Federal cost. *Recommendation:* Concept appears to be workable, but interest by local hunters is uncertain. Decision deferred until after public review of the draft EIS. Could only be implemented for the Trestle-Channel alternative.

Minimize free-strung wires and other structural components likely to result in bird strikes. Wires and other structural components that are hard to see could increase the chances for strikes by migratory waterfowl. These components may be reduced or avoided during project design. Cost to project: unknown. *Incremental evaluation*: No Federal cost. *Recommendation:* Tentatively recommended in the draft EIS for the Breakwater-Fuel Transfer and Trestle Channel alternatives.

Restrict lighting in conditions that would increase probability of bird strikes or use hood lights to avoid attracting or disorienting birds. Intense lighting can disorient or temporarily blind birds, increasing potential for bird strikes. Hooding work lights or restricting their use at night has been shown to reduce bird strikes at some locations during migratory periods. *Incremental evaluation*: No Federal cost. Cost to project: included in construction costs. *Recommendation:* Tentatively recommended in the draft EIS for the Breakwater-Fuel Transfer and Trestle Channel alternatives.

Paint the trestle, platform, and loaders a color highly 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 could 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. They could be visually intrusive to people at Portsite and Kivalina and to people passing through the area. Cost to project: included in project construction costs. *Incremental evaluation*: No Federal cost. *Recommendation:* Tentatively recommended in the draft EIS for the Trestle-Channel alternative; pending public review.

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. Cost to the project: unknown. *Incremental evaluation*: No Federal cost. *Recommendation:* Not recommended. Not enforceable with existing regulations, and there is no indication that this action would reduce or avoid impacts.

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: about $30,000. *Incremental evaluation*: Work is the minimum required to meet cultural resource protection requirements. *Recommendation*: Tentatively recommended in the draft EIS for the Breakwater-Fuel Transfer and Trestle Channel alternatives.

Require 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. Cost to project: about $20,000. *Incremental evaluation*: Presenting less training will not accomplish objectives. *Recommendation*: Tentatively recommended in the draft EIS for the Breakwater-Fuel Transfer and Trestle Channel alternatives.

Require dredged material to be disposed of in the up-current part of any ocean disposal site. 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 of transportation time to the project. *Incremental evaluation*: The need for this measure and incremental costs to the project will be estimated after completion of the DMDSS. *Recommendation*: Not recommended, pending DMDSS completion. *Other alternatives:* This measure would not be required for other alternatives.

Monitor dredged material plume at and down-current from the disposal site. Data collected during initial dredged material disposal operations could be used to modify disposal operations if required. Cost to project: about $50,000. *Incremental evaluation*: This is the minimum cost for one data set during a reasonable range of marine conditions. *Recommendation*: Tentatively recommended in the draft EIS for the Breakwater-Fuel Transfer and Trestle Channel alternatives.

Restore littoral transport by removing the existing solid-fill dock. The existing solid-fill dock at Portsite interrupts the natural long-shore drift of sediments and appears to have caused beach erosion south of the dock. The dock is needed for Portsite operations. It could be replaced by another structure, but removal and replacement costs would exceed $20 million and the accretion problem from wave effects of the channel and turning basin would still be unmitigated. Moving material that accretes on the north side of the dock to the south side of the dock during annual bypass dredging could mitigate both effects less expensively. Cost to project: $20 million *Recommendation*: Not recommended in the draft EIS for the Breakwater-Fuel Transfer and Trestle Channel alternatives.

Conduct annual by-pass dredging to maintain beach processes south of Portsite. Wave reduction caused by the trestle-channel and breakwater-Fuel transfer alternatives 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. This would increase existing bypass dredging sufficiently to fully restore long-shore transport. Dredging would be evaluated and volumes would be adjusted to maintain natural processes. Dredging would be timed to avoid subsistence activities and anadromous fish out-migration events. Cost to project: $325,000. *Incremental evaluation*: 1. Reducing the dredging interval for incremental cost savings would not be practicable. A dredge probably would be kept on-site for this requirement, so dredging less frequently would save little expense. Down-current beach erosion could be unacceptable if by-pass dredging was less frequent. 2. Dredging only part of the material would cause accumulation of material and down-current beach erosion. Incremental analysis is not required for this mitigation feature. *Recommendation*:

Tentatively recommended in the draft EIS for the Breakwater-Fuel Transfer and Trestle Channel alternatives.

Work with Noatak to evaluate feasibility of a road between the DMTS 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 in the Red Dog Mine. A road connecting Noatak and the DMTS road could reduce both problems. This is outside the scope of the EIS, but the nonfederal 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 project. *Recommendation*: Tentatively recommended in the draft EIS for the Breakwater-Fuel Transfer and Trestle Channel alternatives.

Involve regional distributors in fuel distribution planning to support local and regional employment and economic objectives. Regional fuel distribution out of Portsite could affect distributors that now do business in Northwest Alaska. Involving them in specific plans to meet fuel distribution objectives would allow those distributors to maintain or grow their position in this business. No cost to the project. *Recommendation*: Tentatively recommended in the draft EIS for the Breakwater-Fuel Transfer and Trestle Channel alternatives.

Encourage construction contractors to hire locally as job positions allow. Federal regulations regarding local hire incentives in construction contracts for Federal projects are subject to change but frequently permit contract language that encourages contractors to hire local labor. The strongest incentives consistent with Federal regulations, such as small and disadvantaged business set asides, minority hire goals and evaluation of proposed subcontracting plans during the source selection process could be considered for insertion in contract documents. No cost to the project. *Recommendation*: Tentatively recommended in the draft EIS for the Breakwater-Fuel Transfer and Trestle Channel alternatives.

Table 2-1. Summary of Environmental Consequences.

RESOURCE OF CONCERN		ALTERNATIVES			
		No Action	3rd Barge	Breakwater-Fuel Transfer	Trestle-Channel
VEGETATION					
Vegetation/Wetlands	ST / LT	No effect	No effect	Minor Local	Minor Local
INVERTEBRATES					
King crab	ST / LT	No effect	No effect	Minor Local	Minor Local
Hyas and Telmessus crabs	ST	No effect	No effect	Minor Local	Minor Local
	LT				No effect
Shrimp species	ST	No effect	No effect	Minor Local	Less than Significant Local
	LT				No effect
Worms and clams	ST	No effect	No effect	Minor Local	Less than Significant Local
	LT			No effect	Minor local
Freshwater fish	ST / LT	No effect	No effect	No effect	No effect
Anadromous fish	ST	No effect	No effect	Minor Local	Minor Local
	LT			No effect	No effect
Marine fish	ST / LT	No effect	No effect	Minor Local	Minor Local
MARINE MAMMALS					
Belugas	ST / LT	No effect	No effect	Minor Local	Minor Local
Bowhead whale	ST / LT	No effect	No effect	Minor Local	Minor Local
Gray whale	ST / LT	No effect	No effect	Minor Local	Minor Local
Harbor porpoise	ST / LT	No effect	No effect	No effect	No effect
Ringed seal	ST / LT	No effect	No effect	Minor Local	Minor Local
Bearded seal	ST	No effect	No effect	Minor Local	Minor Local
	LT			No effect	No effect
Spotted seal	ST	No effect	No effect	Minor Local	Minor Local
	LT			No effect	No effect

Pacific walrus	ST	No effect	No effect	No effect	No effect
	LT				
Polar bear	ST	No effect	No effect	No effect	No effect
	LT				
TERRESTRIAL MAMMALS					
Caribou	ST	No effect	No effect	No effect	No effect
	LT				
Moose	ST	No effect	No effect	No effect	No effect
	LT				
Small mammals	ST	No effect	No effect	No effect	Minor Local
	LT				
BIRDS					
Waterfowl	ST	No effect	No effect	No effect	Minor Local
	LT				
Other birds	ST	No effect	No effect	No effect	Minor Local
	LT				
RESOURCES OF SPECIAL CONCERN					
Endangered species	ST	No adverse effect	No adverse effect	No adverse effect	No adverse effect
	LT				
Essential fish habitat	ST	No effect	No effect	No effect	No effect
	LT				
CULTURAL/ECONOMIC RESOURCES					
Cultural properties	ST	No effect	No effect	Minor Local	Minor Local
	LT				
Subsistence	ST	No effect	No effect	Less than significant Local	Potentially significant local
	LT				
Visual resources	ST	No effect	No effect	Minor Local	Minor Local
	LT				
Regional economics	ST	No effect	No effect	No effect	Minor Local
	LT			Potentially significant Local/Regional beneficial	Potentially significant Local/Regional beneficial
PHYSICAL RESOURCES					
Air quality	ST	No effect	Minor Local	Minor Local	Minor Local
	LT		No effect	No effect	Minor Local beneficial
Marine water quality	ST	No effect	No effect	Minor Local	Minor Local
	LT				
Freshwater quality	ST	No effect	No effect	No effect	No effect
	LT				
Sediment quality	ST	No effect	No effect	No effect	No effect
	LT			Minor Local beneficial	Minor Local beneficial

Noise	ST	No effect	No effect	No effect	Minor Local adverse
	LT		Minor Local	Minor Local	Minor Local beneficial
Oceanography	ST	No effect	No effect	Minor Local	Minor Local
	LT				

Notes about effects.

1. Information in this table is based on existing conditions described in Section 3 of this DEIS and on the evaluation of environmental consequences presented in Section 4. All effects summarized in this table include cumulative effects and represent anticipated or potential changes from existing conditions.
2. All listed effects are adverse unless otherwise annotated.
3. The summary of consequences to resources that follows in table 2-1 identifies impacts to specific resources that could be significant in the context of CEQ regulations. All other impacts are considered to be less than significant. Lesser levels of intensity are estimated in terms of the following values:

Context of Effect

LOCAL — Area around potential project features where resources would be directly and immediately affected by an alternative. For practical purposes, this is generally about 15 miles seaward of Portsite and within 1 mile inland.

REGIONAL — For physical, social, and cultural resources: Northwest Arctic Borough and southeastern Chukchi Sea. For biological resources: the range of potentially affected populations.

Duration of Effect

Short-term (ST) — Effects during construction and maintenance and no more than 2 years following those events

Long-term (LT) — Effects lasting longer than 2 years after construction or periodic maintenance events.

Intensity of Effect

Significant	This is based in National Environmental Policy Act (NEPA) implementing regulations, guidance, and court interpretation. In general, it means: The alternative could, as compared to existing conditions, broadly and substantially alter the value of affected social or cultural resources, species role and function in the ecosystem, species regional abundance or range; or that the alternative could substantially affect a broad area of habitat essential to one or more species; or could substantially and broadly affect other resources of particular ecological or social importance. Cumulative effects could, acting together with past and reasonably foreseeable future effects, cause significant impacts, or could significantly increase already substantial and broad effects.
Less than significant	Effect of the alternative cannot be accurately predicted with available data, but can be demonstrated to be less than significant in relationship to established NEPA regulations, guidance, and case law.
Minor effect	Direct effects of the alternative would cause negligible changes from existing conditions or would result in no more than local alteration of cultural and social resources, habitat, species behavior, or species availability to prey species, but would not affect observable regional abundance, geographic range, social importance, or ecosystem function. Cumulative effects would not add to other past or reasonably foreseeable future effects sufficiently to cause significant effects.
No effect	The alternative would not alter the existing condition of a resource, its behavior, or its biological, cultural, or economic importance to the ecosystem or the importance of its social value.

<u>Notes about cumulative effects</u>:

1. Table 2-1 is intended primarily to provide information for decision making about possible Federal actions rather than for assessment of past impacts. The summary information presented here incorporates direct impacts and secondary impacts (including cumulative impacts) as defined in Section 4.1 and focuses on present and reasonably foreseeable actions. Past effects are addressed in Section 4 of the DMT draft EIS, but are only included in the summary columns of table 2-1 where direct, present, and reasonably foreseeable future effects could cumulatively become significant, as defined in section 4.1.

2. This table necessarily presents information about effects of alternatives on individual resources or groups of resources. The sums of minor or less than significant effects to multiple resources may constitute an action that could significantly affect the human environment in the context of NEPA. Analysis of all potential impacts did not identify any combination of impacts to resources that would cumulatively cause a significant adverse

effect on the human environment. Evaluation of data quality and uncertainty about potential for high-risk low-probability impacts did identify one issue, *local subsistence harvest of bowhead and beluga whales*, where available data cannot assure that the tentatively recommended plan (Trestle-Channel alternative) or the Breakwater-Fuel Transfer alternative would not cumulatively cause significant adverse impacts to the subsistence harvest of those animals by people on the Chukchi seacoast near Portsite. Kivalina is the only community that might thus be significantly affected. Additional data collection would not resolve the underlying questions and would not allow a more useful prediction of potential for adverse effects.