ENDANGERED SPECIES ACT: SECTION 7 CONSULTATION
Biological Opinion

Activities considered: Marine Terminal Redevelopment Project at the Port of Anchorage

Action Agency: U.S. Department of Transportation, Maritime Administration,
Port of Anchorage Administration
U.S. Army Engineer District, Alaska

Consulting Agency: National Marine Fisheries Service, Alaska Region

Date Issued: 8.24.11

Approved By:

Executive Summary

The U.S. Department of Transportation (DOT), Maritime Administration (MARAD), U.S. Army Engineer District, Alaska, and NOAA Fisheries' Division of Permits, Conservation, and Education (NOAA PCD), have requested formal consultation on the Port of Anchorage Intermodal Expansion Project (PIEP) – referring to the entire Port of Anchorage Expansion Project, including in-water and land-based endeavors, and the Marine Terminal Redevelopment (MTR) Project - a subset of the PIEP, which includes construction of the marine terminal docks and involves the in-water portion of the PIEP, by a letter dated February 19, 2010. This consultation considers the effects of this action on the critical habitat of the endangered Cook Inlet beluga whale. In formulating this consultation, NOAA Fisheries used information presented in the March 2010 Addendum to Biological Assessment of the Beluga Whale *Delphinapterus leucas* in Cook Inlet for USACE Dredging and Marine Terminal Redevelopment Project at the Port of Anchorage, Alaska, the October 2008 Conservation Plan for the Cook Inlet Beluga Whale, the 2008 Status Review and Extinction Risk Assessment of Cook Inlet Belugas (*Delphinapterus leucas*), and the 2008 Final Supplemental Environmental Impact Statements for the Cook Inlet Beluga Whale Subsistence Harvest, along with other research relating to beluga whales and information provided by NOAA's National Marine Mammal Laboratory, the State of Alaska, and the traditional knowledge of the Alaska Native community. The final rule for CIB critical habitat was published on April 11, 2011 (76 FR 20180). In the final rule, the Port of Anchorage was excluded from the areas designated as critical habitat. The principal benefit from excluding the POA is avoiding the risk that the designation might impede the POA's operations or otherwise result in a reduction in military readiness.

Contents

1.0 INTRODUCTION

This document transmits the National Marine Fisheries Service's (Service or NMFS) biological opinion based on our review of the proposed Port of Anchorage expansion project and its effects on the critical habitat of the Cook Inlet beluga whale in accordance with section 7 of the Endangered Species Act (Act) of 1973, as amended (16 U.S.C. 1531 et seq.). A complete administrative record of this consultation is on file at this NMFS office.

1.1.1.1 ***Consultation History***

DOT's February 19, 2010, letter to NMFS requested formal consultation under section 7 (a)(2) of the ESA for ongoing port expansion activities at the Port of Anchorage. The DOT provided a Biological Assessment of this action, which was received in June of 2010. NMFS acknowledged receipt of this information and initiated formal consultation in our letter dated October 13, 2010. This consultation began as a conference under ESA regulations because we were consulting under the proposed rule for critical habitat for CIB. When the final rule for critical habitat was passed on April 11, 2011, this consultation became a formal biological opinion under the ESA.

Previous to this consultation, NMFS issued a separate biological opinion on the effects of this project on the status of the Cook Inlet beluga whale (NMFS 2010).

1.1.1.2 ***Term of this Biological Opinion***

This biological opinion does not rely on the regulatory definition of "destruction or adverse modification" of critical habitat at 50 CFR 402.02. Instead, we have relied upon the statutory provisions of the ESA to complete the following analysis with respect to critical habitat.

This opinion will be valid upon issuance.

Much of the information provided in this biological opinion was provided in an earlier biological opinion on Cook Inlet Begula whales (NMFS 2010) and in the biological assessment provided by the action agency (ICRC 2010).

1.1.1.3 ***Terms of the Current Letter of Authorization***

Under the 1994 Amendments to the MMPA, harassment is statutorily defined as, any act of pursuit, torment, or annoyance which--

- ***Level A Harassment*** has the potential to injure a marine mammal or marine mammal stock in the wild; or,

- ***Level B Harassment*** has the potential to disturb a marine mammal or marine mammal stock in the wild by causing disruption of behavioral patterns, including, but not limited to, migration, breathing, nursing, breeding, feeding, or sheltering but which does not have the potential to injure a marine mammal or marine mammal stock in the wild.

From the current Letter of Authorization, "The Port of Anchorage and the U.S. Department of Transportation Maritime Administration are hereby authorized, under section 101(a)(5)(A) of the Marine Mammal Protection Act (16 U.S.C. 1361 et seq.; MMPA) to take, by Level B harassment, small numbers of marine mammals incidental to in-water pile driving associated with the Port of Anchorage Marine Terminal Redevelopment Project, subject to the provisions of the MMPA, the Regulations Governing Small Takes of Marine Mammals Incidental to Specified Activities (50 CFR Part 217, Subpart U) (Regulations) and the following conditions:

1. This Authorization is valid from July 15, 2010 through July 14, 2011.
2. This Authorization is valid for the taking, by Level B harassment only, of 34 Cook Inlet beluga whales *(Delphinapterus leucas*), 20 harbor porpoises (*Phocoena phocoena*), 5 killer whales (*Orcinus orca*), and 20 harbor seals (*Phoca vitulina*). The taking by serious injury or death of these species, or the taking by harassment, injury or death of any other species of marine mammal, is prohibited and may result in the modification, suspension or revocation of this Authorization."

1.1.1.4 ***Action Area***

The action area is defined as all areas to be affected directly or indirectly by the federal action (50 CFR §402.02). For purposes of this Biological Opinion, the action area is defined as all waters of Knik Arm near Anchorage, Alaska within five (5) kilometers of the Port of Anchorage (Figure 1). In the final rule for CIB critical habitat, published on April 11, 2011 (76 FR 20180), NMFS exempted the POA from the area designated as critical habitat for the Cook Inlet beluga whale for reasons of national security. Under the ESA Exemptions, paragraph B, section (j) "Notwithstanding any other provision of this Act, the Committee shall grant an exemption for any agency action if the Secretary of Defense finds that such exemption is necessary for reasons of national security." NMFS wanted to avoid the risk that the designation might impede the POA's operations or otherwise result in a reduction in military readiness (Figure 2). Effects from the action could still exist outside the exempted area, so the effects of this action on other areas of critical habitat are analyzed in this document.

The MARAD BA defined the action area to include all waters of Knik Arm that may be affected by project-related sound equal to or above 125 dB re:1 µPa. The BA established the maximum expected distance for such noise to be 4,257 m. However, because actual sound measurements for future construction actions have not occurred we have increased the radius to 5 kilometers. We believe this distance should reasonably describe the 125 dB soundfield for the work associated with the port expansion. The direct and indirect effects of this action on the endangered Cook Inlet beluga whale are expected to be confined to the action area.

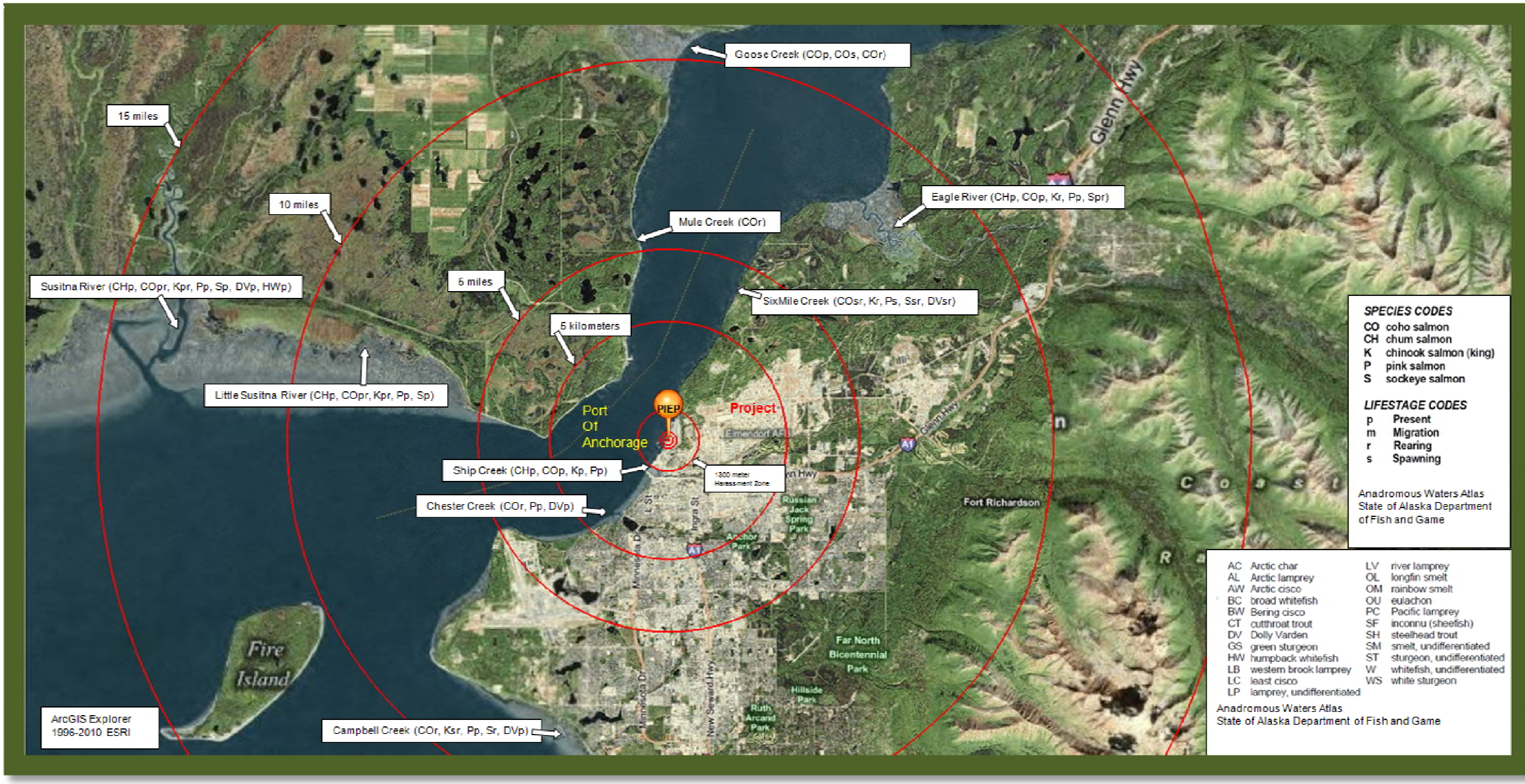


Figure 1. Project Area. Innermost concentric circle represents 1,300 harassment zone. Next circle out has a 5km radius. (BA, 2010).

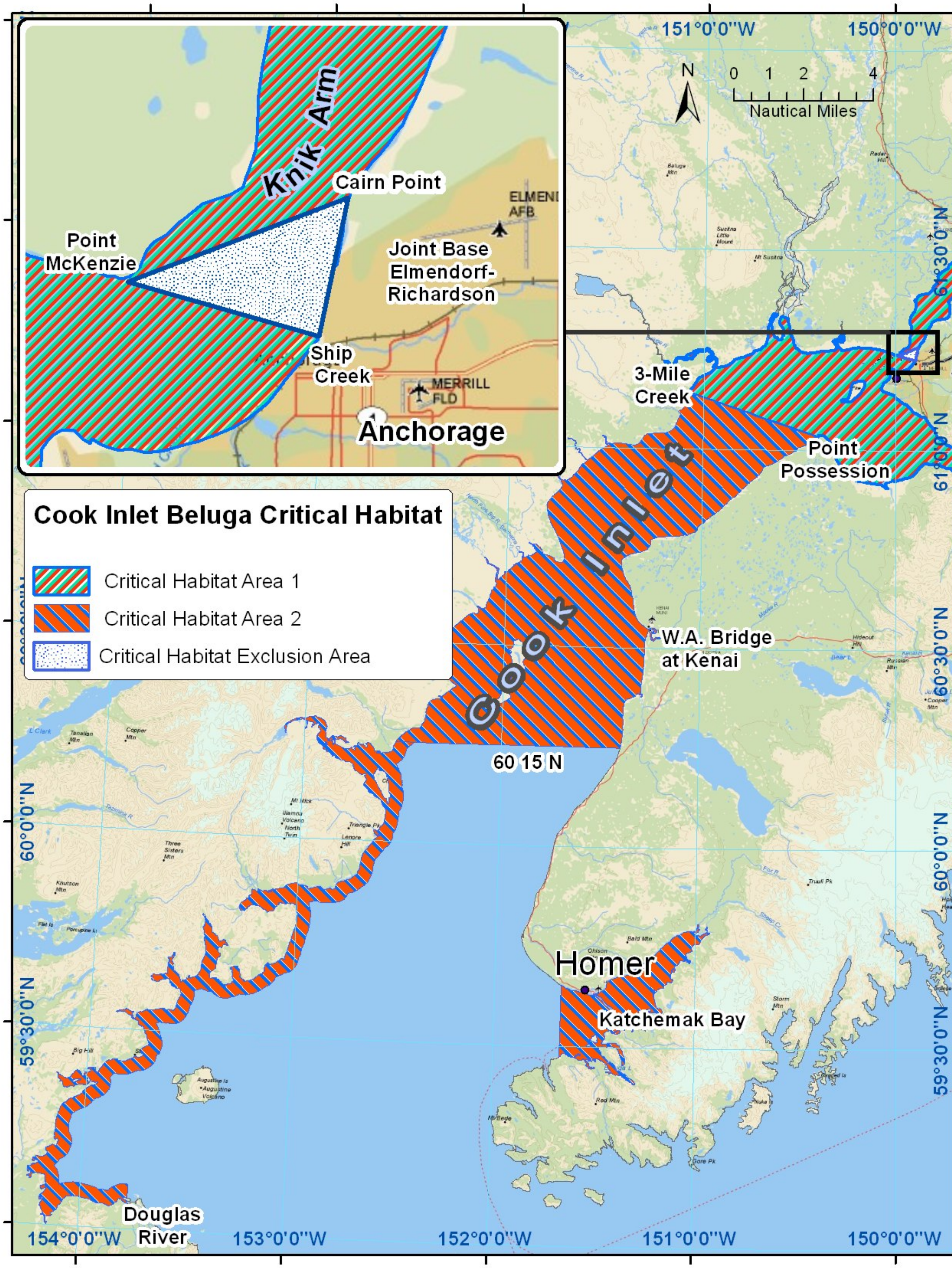


Figure 2. Cook Inlet Beluga Critical Habitat and POA exclusion.

2.0 DESCRIPTION OF THE PROPOSED ACTION

This consultation will address the Marine Terminal Redevelopment Project at the Port of Anchorage (POA), Alaska. Its purpose is to provide an assessment of this action on the critical habitat of the Cook Inlet beluga whale, as well as to provide measures to mitigate impacts. The Maritime Administration, as lead federal agency, and the Port of Anchorage (POA) continue to oversee the ongoing Port of Anchorage Intermodal Expansion Project (PIEP), including the Marine Terminal Redevelopment (MTR) Project. For the purposes of this document, the Port of Anchorage Intermodal Expansion Project (PIEP) refers to the entire Port of Anchorage Expansion Project, including in-water and land-based endeavors. The MTR Project is a subset of the PIEP, which includes construction of the marine terminal docks and involves the in-water portion of the PIEP.

Congress has directed the Army Corps of Engineers to dredge the POA to support the MTR Project as part of ongoing operations. Integrated Concepts & Research Corporation (ICRC), prime contractor for the Maritime Administration, is managing the PIEP construction. Current PIEP construction activities are authorized under the Corps 404/10 Permit POA-2003-502 issued August 2007, a Letter of Authorization (LOA) issued July 2009 by the National Marine Fisheries Service (NMFS) under the Marine Mammal Protection Act (MMPA), and the Biological Opinion (BiOp) issued July 2009 by NMFS under the Endangered Species Act (ESA) to address the endangered Cook Inlet beluga whale.

Overview of the Project

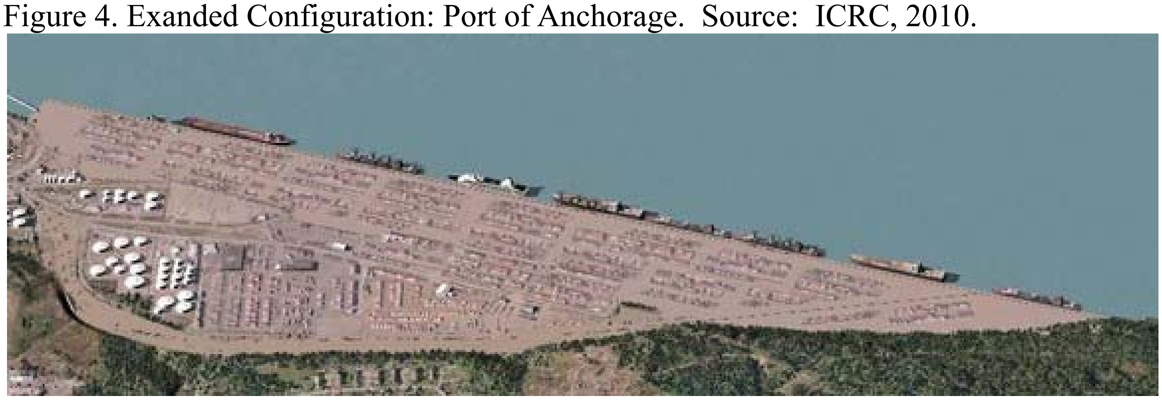
The MTR is being conducted through a partnership between the Port of Anchorage and the U.S. Department of Transportation Maritime Administration. The Anchorage Assembly approved a Memorandum of Agreement by and between the Port of Anchorage and the Maritime Administration to establish the Maritime Administration as the lead federal agency with responsibility to administer federal, State, and local dollars on behalf of the Municipality to oversee the expansion. The Port has stated that it serves 85 percent of the population within Alaska by providing 90 percent of all consumer goods for the state. The Port has exceeded the maximum sustainability point where the aging facility can maintain efficient operations. The existing dock no longer can be widened nor salvaged due to its advanced age and state of disrepair. The infrastructure and support facilities are substantially past their design life and have degraded to marginal levels.

The rehabilitation and expansion of the Port is also critical to improving national defense capabilities and provides additional land and facilities necessary to support military deployments during and after construction. The Port is one of 19 nationally designated Strategic Ports with direct calls scheduled by the Department of Defense for critical deployments in-and-out of Alaska's military bases, training facilities and other defense theaters around the globe. The designation requires the Port to provide the military with 25 contiguous acres for their operations within 24 hours notice.

The ongoing MTR Project will rebuild and enlarge docking facilities, improve loading/unloading facilities, provide additional working space to handle shipped fuel, freight and other materials, and improve access by road and rail transportation serving the Port. The new expanded Port will provide efficient transport of goods into and out of Anchorage for the next 50 years and more. Upon completion, the phased MTR project will add 135 acres of useable land to the current 129 acre POA (total area of 264 acres). The completed marine terminal at the POA will include: seven modern dedicated ship berths; two dedicated barge berths; rail access and intertie to the Alaskan railbelt; roadway improvements; security and lighting improvements; slope stability improvements; drainage improvements; modern shore-side docking facilities; equipment to accommodate cruise passengers, bulk, break-bulk, roll on/roll off (RO-RO) and load on/load off (LO-LO) cargo, general cargo short-term storage, military queuing and staging, and petroleum, oils, and lubricants (POL) transfer and storage; and additional land area to support expanding military and commercial operations.

Figure 3. Port in 2005; Prior to Expansion Project Activities. Source: ICRC, 2010.

Figure 4. Exanded Configuration: Port of Anchorage. Source: ICRC, 2010.



Construction for the MTR Project began in 2006, prior to the ESA listing of Cook Inlet beluga whales, and is anticipated to continue through November 2014. Creation of over 65 of the 135 unimproved acres has been completed to date: thus far, 26.8 acres were added in 2006; 22.4 acres were added in 2007; and 18.4 acres were added in 2008. Future efforts will add 8.4 acres in 2010; 14.15 acres will be added in 2011; 29.85 acres will be added in 2012; and 15.35 acres in 2013.

The MTR Project components are divided into several construction phases to accommodate continuous Port operations throughout construction. Since phased construction began in 2006, the Port has added a total of 43.4 acres of surface area by filling 21 acres in the North Backlands, 8.6 acres in the South Backlands, and 13.8 acres for the Barge Berths phase. Continuing project construction includes both in-water and out-of-water activities, including:
•Dredging,
•Placement of fill material,
•Installation of open cell sheet pile (OCSP) waterfront substructures,
•Additional road, rail, and utilities extensions,
•Installation of final docks,
•Fendering systems to accommodate off-shore shipping operations, and
•Demolition of the existing docks.

2.1.1.1 ***Dredging***

The following dredging methods will be used to accomplish the range of dredging phases at the Port: Clamshell Dredge; Dipper Dredge; Hopper Dredge; and Cutterhead Suction Pipeline Dredge. All types of dredges described below will not be present simultaneously. Tug boats are an essential component of dredging operations when clamshell or dipper dredges are used.

Current Maintenance Dredging

The expanded port facility will require annual maintenance dredging to remove sediments and provide navigational depths for vessels. This work will be done by the Corps of Engineers. The Corps dredges sediment every year to maintain the -35-foot MLLW authorized federal depth in the approach channel and in the berthing areas of the Port. The amount of dredging required to maintain the Port varies from year to year, with a maximum of about 2.1 million cy of material dredged in 2004. The sedimentation rate at the Port has increased in the last decade for reasons that are not fully understood. Annual maintenance dredging and disposal activities at the Port generally begin in mid May, shortly after the ice is out of the inlet, and continue into November, depending on weather. Sediments dredged by current annual maintenance operations have been evaluated to determine the presence of contaminants (Corps 2008). Samples were collected and tested for volatile and semi-volatile organic compounds, total recoverable petroleum hydrocarbons, polychlorinated byphenols (PCBs), pesticides, cadmium, mercury, selenium, silver, arsenic, barium, chromium, and lead. Contaminant concentrations in the samples were below screening levels (State of Washington, Department of Ecology, Sediment Management Standards Minimum Clean-up Levels-Chemical Criteria) and have been determined to be suitable for in-water discharge. Although the sediment does not contain significant contaminant concentrations, dredging and disposal activities create localized increases in suspended sediment concentrations and turbidity and slightly lower dissolved oxygen concentrations at the dredging and disposal sites.

After the Port expansion is complete and post-expansion deepening is complete, maintenance dredging will continue as it has in the past, only it will occur in a different footprint since the old footprint will be covered by fill material for the expanded Port. Maintenance dredging will also occur to -45 feet MLLW in some areas that are now maintained to -35 feet MLLW. Maintenance dredging to -45 feet MLLW will continue on an annual basis as has been the case for past and current maintenance dredging. In the past, maintenance dredging has typically involved two or three dredges. Future maintenance dredging will involve a similar number since it is more cost effective to keep the number of dredges to the minimum. Additional production can be gained by increasing the size of the crane or excavator (for clamshell or dipper dredges) so that larger clamshells or buckets can be used.

Dredged material is transported to the disposal site by tug and barge and discharged in increments of approximately 1,500 cy. The dredged material is cohesive and when released from the barge is deposited in a large mass at the disposal site. A large percentage reaches the bottom. The deposited dredged material is dispersed through Knik Arm by the strong tidal currents. Surveys of the area and bathymetric measurements performed every year under contract to the Corps show material has not remained at the disposal site (Corps 2008).

Construction Dredging

In-water construction dredging for the MTR Project is performed prior to pile driving to remove soft sediments and provide a sound foundation for the steel retaining structure and the fill behind the structure. To date, this dredging has been performed using one dipper or clamshell dredge and associated tug and dump scow for dredge material disposal. Dredged materials will be transported approximately 3,000 feet offshore to the authorized disposal site currently used by the Corps for harbor maintenance dredging.
Transition dredging will likely involve two or three dredges in addition to those used for maintenance dredging, yielding a total number of four to six dredges that will likely be used for both maintenance and transition dredging. The actual number of dredges used will depend on the type and capacity of each dredge deployed to the Project.

Post-expansion deepening of the harbor will also require dredging. Dredging will deepen the harbor in this area to -45 feet MLLW once the expansion of the Port is complete. It will deepen part of the area previously deepened to -35 feet MLLW so that container vessels with greater operating drafts could use the Port. This area could be dredged as early as 2012, but will not occur until transition dredging is complete, thus reducing the number of dredges that could operate simultaneously. Like transition dredging discussed above, the total number of dredges during maintenance and post-expansion deepening will be around four to six total dredges.

The dredging season typically runs between May and November each year. It is unlikely to start before the middle of May due to long mobilization times to Anchorage from locations outside of Alaska, and work past early November is not desirable due to short daylight hours and the likelihood of ice formation. Dredging usually occurs 24 hours per day for 6 days per week, with one day per week set aside as a maintenance day. Because the seasonal/daily work window is completely utilized, any need for increased dredging must be addressed by increasing the number of dredges or, for clamshell or dipper dredges, using larger clamshells or buckets.

Dredged Material Disposal

Dredged materials will be disposed of at a marine disposal site in lower Knik Arm. This site has been used for many years. The site is in relatively deep water where tidal currents are relatively strong and where the discharged material is rapidly suspended and dispersed into the already turbid waters of Knik Arm. The millions of yards of material discharged over the past several years into that site have not caused any discernable accumulation at the disposal site or on the inlet bottom around the site. The existing disposal site might be sufficient for construction and future maintenance dredging, but this is uncertain. Deposition in the present disposal site could eventually raise the bottom enough to affect navigation. Therefore the Corps has enlarged the disposal site to allow the spread of dredged material over a larger area. The additional disposal area will prevent discharged material from accumulating excessively in one location. This will avoid potential effects to navigation and changes in bottom configuration that could affect water movement.

2.1.1.2 *Placement of Fill Material*

Project fill activities will require approximately 9.5 million cy of suitably engineered and clean granular fill and common fill material for placement behind vertical steel or rock-retaining features. The POA and the Maritime Administration, in cooperation with EAFB, will use primarily certified clean government-furnished fill material from two borrow sites, transported to the Port by truck. Some fill material may also be obtained from existing commercial sources as needed, and could include transport by barge, truck, or train to the Project site. Fill material will be screened to ensure compliance with stringent specifications for grain size, is to be laboratory tested to ensure all material placed is contaminant-free, and certified as fully suitable for the intended purpose. Large armor rock will be placed in some areas for permanent erosion control. Rock rip-rap will be placed on the temporary slopes exposed to tide and wave action at the end of interim construction phases for erosion protection. Rock placed on temporary slopes will be recovered and reused as construction proceeds.

2.1.1.3 *Installation of open cell sheet pile (OCSP) waterfront substructures*

The Port expansion will require extensive placement of piling in the waters of Knik Arm. Both steel pipe piles and vertical sheet piles will be used. The new bulkhead waterfront structure will be comprised of conjoining face and tail sheet-pile cells, forming a row of U-shaped open cell sheet pile (OCSP) structures, with the face placed parallel to and approximately 400 ft (122 m) seaward of the existing dock face. The face of each OCSP cell is curved outward, creating a scalloped surface (see application for figures of sheet pile design). The face and immediately adjoining primary tail walls are installed using vibratory or impact pile driving procedures from either land-based or barge-based pile driving equipment. The dock face will be constructed in areas that are completely submerged (below low tide). Primary tail walls are installed in areas that are below low tide and in areas that are tidally influenced or intertidal (in-water during high tide and out of the water during low tide), and areas completely out-of water. Only driving piles installed in-water in the submerged and intertidal zones has the potential for impacting marine mammals.

Two main methods used to install piles are impact and vibratory pile driving. An impact hammer is a large metal ram that is usually attached to a crane. A vertical support holds the pile in place and the ram is dropped or forced downward. The energy is then transferred to the pile which is driven into the seabed. The ram is typically lifted by mechanical, air steam, diesel, or hydraulic power sources. The POA/MARAD have indicated that an impact hammer similar to Delmag D30-42 diesel, 13,751 lb hammer with a maximum rated energy of 101 kilojoules (kj) will likely be used; however, this may be slightly altered based on the contractor. Driving piles using an impact hammer generally results in the greatest noise production; however, this noise is not constant and is considered as a multiple pulse source by NMFS. NMFS' current acoustic threshold for pulsed sounds (e.g., impact pile driving) is 180 and 190dB re 1 microPa for Level A harassment of cetaceans and pinnipeds, respectively, and 160 dB re 1 microPa for Level B harassment.

Vibratory hammers install piles by applying a rapidly alternating force to the pile by rotating eccentric weights about shafts, resulting in a downward vibratory force on the pile. Vibratory hammers are attached to the pile head with a clamp and are usually hydraulically powered. The vertical vibration in the pile disturbs or liquefies the soil next to the pile causing the soil particles to lose their frictional grip on the pile. The pile moves downward under its own weight plus the weight of the hammer. This method is very effective for non-displacement piles such as sheet piles, H-beams, and open-end pile or caissons. NMFS has established a 180/190dB threshold for Level A harassment; however, no Level B threshold is currently implemented across the board due to the immense variability in acoustic behavioral studies. In issuing an Incidental Harassment Authorization pursuant to the Marine Mammal Protection Act in 2008, NMFS utilized a threshold of 120dB for Level B harassments from vibratory pile driving; however, acoustic studies in Knik Arm provide overwhelming evidence that background levels around the POA are consistently at or above this level, in absence of POA related construction. Therefore, NMFS proposes to implement a 125dB threshold for Level B harassment for vibratory pile driving.

The type of hammer used depends on subsurface conditions and the effort required to advance the sheet pile to final elevation. The difference between the top of adjacent sheets can be no more than 5 feet at any time. This means that the sheets will be methodically driven in a stair-step pattern and the hammer will move back and forth along the cell until all sheets are driven to depth. This stair-step driving pattern results in short periods of driving. For the vibratory hammer, driving is in progress from less than 1 to approximately 3 minutes followed by a minimum 1- to 5-minute period with no driving, while the vibratory hammer is moved and reset. When the impact hammer is being used, driving takes place from less than 1 to 20 minutes, followed by a period of no driving, while the hammer is moved and reset (between 1 and 15 minutes). Where driving conditions allow, two or three adjacent sheet piles may be driven simultaneously (the grips on the vibratory hammer allow one to three sheets to be driven at a time). Actual driving time is determined by local soil conditions. The COE permit and MMPA small take authorization (Incidental Take Authorization) for this work require that all piles be driven with the vibratory hammer and only use the impact hammer when vibratory methods are not sufficient to achieve proper depth. Pile driving and fill placement will occur during the summer construction season and cease once inclement weather either results in presence of harbor ice (limiting in-water pile driving and construction dredging activities) or frozen soils (limiting fill placement and consolidation activities). Demolition activities and miscellaneous surfacing activities, such as overhead utility installation, could occur during the winter construction season.

2.1.1.4 ***Demolition of Existing Dock***

Different parts of the existing, active dock will be demolished in phases as each section of the expansion is constructed. That depends on project funding and sequence of the construction. At this time, it is estimated that the demolition would start in 2013 and continue intermittently through 2017. It is likely to be completed in three phases. Phase 1 of dock demolition, originally scheduled for 2010/2011 but has not yet begun, will focus on the northern portion of the existing dock. The existing dock is inside the footprint of the planned MTR project; therefore, all concrete debris from demolition would be in areas already planned to be filled in during the construction of the new dock. The existing dock encompasses approximately 400,000 sq ft of surface area and is comprised of an 18 to 24-inch thick steel reinforced concrete deck supported by over 4,000 steel piles. Select structural portions of the concrete deck are up to 3 to 4 feet thick. Pile diameters range from 24 to 48 inches with a wall thickness of 7/16 inch and are filled with gravel. POA expansion activities will include the demolition of the existing dock structure to allow the placement of gravel fill to extend the functional wharf line approximately 400 feet beyond the existing dock face.

The Port submitted a demolition plan to NMFS that outlines three possible methods for demolition and mitigation measures for each option. These include (1) in-water demolition by mechanical means using chipping hammers, (2) out-of-water demolition using mechanical means and explosives, and (3) out-of-water demolition by mechanical means only. Demolition approaches for removal of the existing dock structures were reviewed with regard to technical feasibility, cost, and ability to minimize Level B harassment takes of marine mammals. Although the most economical and fastest approach includes combining in-water mechanical means and blasting during winter months, the potential adverse effects to marine mammals of blasting in-water would necessitate extensive mitigation. Therefore, in-water blasting has been eliminated from further consideration.

The specific method of choice cannot be determined at this time due to the need for flexibility in the construction bidding process and to facilitate integration of the demolition work into the other components of the MTR Project, therefore, all three methods are proposed with appropriate, respective mitigation.

In-Water Demolition by Mechanical Means Only- Option 1

Option 1, dock demolition by mechanical means, requires breaking or sawing the existing concrete away from the steel support structure and cutting or breaking the steel piles in summer and winter. Concrete demolition would be accomplished using hydraulic chipping hammers, concrete cutter jaws and crushers, and shears mounted to large tracked excavators. Additional equipment would be used to grab, cut, or load salvaged steel during demolition activities. Demolition of the reinforced concrete deck would be performed by excavators working from the surface of the deck. Large excavators with hydraulic hammers or concrete jaws would chip or break the concrete away from the steel support structure and internal reinforcing steel. The concrete would be broken into small pieces and dropped by gravity to the sea floor below, well within the final MTR Project footprint. The concrete debris on the sea floor would be encapsulated with clean fill material and left in place. Alternately, a subcontractor may choose to saw cut the concrete deck into sections and use cranes or large excavators to remove the sections and transport them to shore for use as aggregate elsewhere in the MTR Project. Deck demolition work would begin at the furthest point (waterside) moving toward the shore, and then along access trestles until the final demolition areas are accessible from land. Metal reinforcing steel debris would be segregated and removed with additional excavators and loaded into trucks for removal and recycling. The concrete deck demolition and salvaging of reinforcing steel could occur during any tidal stage.

Steel piles would be cut or broken using heavy equipment as the concrete deck is removed or additional clean granular fill may be placed in the dock area, if necessary, to allow equipment access to remove the remaining steel piles from below the dock. During lower tides the steel piles would be cut using large track mounted excavators with shear attachments or simply bent and broken at least 10 feet below finish grade using excavators with buckets. An alternate access for removal of the steel pile would require use of a tug and barge to approach from the waterside and remove the steel pile after the deck demolition is complete. Salvaged portions of the piles would be removed for recycling. The concrete debris and remaining portions of steel pile would later be encapsulated with clean fill during the construction of the expanded wharf. Option 1 could be accomplished either in the winter or in the summer, but not both, with demolition during the winter being the preferred option. Total demolition activities for Phase 1 of this option (northern portion) are anticipated to continue for approximately 960 hours (60 hours/week x 16 weeks). Demolition of Phase 2 structures (southern portion) is anticipated to take approximately 1,320 hours (60 hours/week x 22 weeks). Concrete demolition activities would be conducted continuously throughout each day; however, steel pile demolition may be limited to low tide cycles for ground access. It is assumed that both portions of work would be performed concurrently, although a portion of the concrete deck must be demolished before steel pile demolition can begin, and steel pile demolition may be limited to low tide intervals.

If Option 1 is chosen, harassment to marine mammals could occur from chipping hammers transmitting sound into the water through the steel piles. Chipping is similar to vibratory pile driving in terms of sound type (i.e., non-pulse), but these hammers operate at 19% less horsepower (i.e., lower energy) than the vibratory hammer and therefore are quieter. In addition, because of the considerable structural mass of concrete that the vibrations would pass through prior to reaching the water, the energy is expected to attenuate to a minimal level. Other cutting tools, such as shears and cutter jaws, operate in short duration at low energy, and do not impart energy directly to the water column or sea floor. Despite demolition activities being quieter than pile driving, the POA/MARAD have proposed to implement the same harassment and safety zones as vibratory pile driving.

Out-of-Water Demolition by Mechanical and Blasting Means- Option 2

Option 2 is comprised of two parts: (1) construct a dike (which acts like a cofferdam) around the existing dock during the summer; and (2) demolish the dock in the winter. The construction of a granular fill dike along the outer limits of the proposed POA expansion area would isolate the existing dock from marine waters allowing demolition to be accomplished out-of-water with a 300-foot land barrier to demolition activities. The dike constructed would be inside the footprint of the area already planned and permitted to be filled in with soil to build the future new dock. The sequence of the filling operations would simply be modified to construct the dike first, demolish the dock, and then complete the remainder of the fill. Dike construction would not result in any additional dewatering or habitat loss.

De-watered dikes/cofferdams represent the most effective way of reducing sound created by impact pile-driving into the water column because the pile is completely decoupled from the surrounding water column. Phase 1 dike construction would begin in the spring to early summer 2011; Phase 2 dike construction would begin in spring or summer 2012. This option would require the construction of approximately 2,600 linear feet (LF) of granular fill dike prior to Phase 1 demolition and approximately 2,300 LF prior to Phase 2. The dike would be constructed of clean granular fill placed by off-road dump trucks and bulldozers and compacted with vibratory rollers, similar to fill activities currently under way. After completion of the dike the contained water will be removed to a depth sufficient to access the limits of the demolition area from below. Summer construction of the dike would be necessary for proper fill placement and compaction and is anticipated to take approximately five months. After dike completion, the dock will be set back approximately 300 feet inland from the water line. Once the dike is completely constructed to accommodate a specific phase of demolition, the applicable concrete deck structure would then be demolished or partly demolished in sections using precision charges (blasting) to break or loosen the concrete. Blasting would expedite the demolition of the concrete structure and will allow for easier handling and removal of concrete and steel debris using mechanical equipment such as track mounted excavators and dump trucks working from an adjacent section of the deck structure or from below.

Blasting would be out-of-water and entail a series of controlled events or shots to demolish the deck in a predetermined sequence of sections. It is anticipated that the dock would be segregated into approximately 30 linear foot sections and that there will be one blasting event for each section (i.e., 30 blasting events total). Each section would be broken up by a single shot event comprised of approximately 150 to 300 charges depending on the size of the section. The section would be prepared by drilling a series of 1-1/4 to 3-inch holes in a gridlike fashion throughout the section footprint. Grid spacing will vary from 2 to 6 feet based on location and concrete thickness. An explosive charge would be placed in each hole, wired to the detonator and covered. Each hole would contain 1/2 to 1 pound (lb) of explosive (no more than 1 lb of explosive would be used for each hole). Additionally, no more than 1 lb of explosives would be detonated within an 8 millisecond (ms) time period. On average, there would be one blasting event per day. Each blast is expected to last no more than 6 seconds. Between 50 and 75 blasting events are estimated for each demolition phase. The duration for mechanical means of demolition of concrete, reinforcing steel and pile, and salvaging is anticipated to be 720 hours (six 10-hour days for 3 months) for Phase 1 and 840 hours (six 10-hour days for 3.5 months) for Phase 2. Therefore, using 75 blasts for six-second durations, each phase of demolition would include up to 450 seconds (7.5 minutes) of blasting over a 3 to 3.5 month period of time (Phase 1 and Phase 2, respectively).

Noise generated at the immediate blast source during dock demolition activities is anticipated to be no greater than 110 dBA in air. This sound level is based upon the estimated charge size and configuration discussed above. The impulse sound is expected to dissipate rapidly from the source.

As standard blasting contractor practice, prior to the commencement of blast demolition, a controlled test blast will be performed on a portion (approximately 1/8) of the first section to verify the blast design and to monitor ground vibration, air overpressure, and water overpressure. Three hydrophones would be used to measure water overpressures outside of the dike structure and three geophones would be used to measure air overpressure along the mainland. Data obtained from the test blast will be extrapolated to model a full section blast. If data from the test blast indicate a potential for noncompliance, the blast design would be modified and a new test blast would be performed. Data will also be collected during each section blast to verify conformance with all applicable sound and air overpressure requirements and to determine if demolition activities require modification. All blasting activities would follow the procedures of an approved blasting plan, the applicable marine mammal harassment mitigation requirements, and the requirements of a health and safety plan outlining the specific requirements for notifying proper authorities, proper signage and safety equipment to be used, personal protective equipment, aircraft, vehicle and pedestrian control, and pre-blast communication. If any marine mammals are sighted within the area of the POA, blasting would be stopped therefore, no marine mammals would be harassed from blasting.

After a portion of the concrete deck is fully removed from the steel support piles, an excavator with a bucket and thumb or shear attachment would break or cut and remove the piles to a point at least 10 feet below the design finish grade in the area of the existing dock. The removed portion of each pile would be salvaged for recycling and the remaining portion would be left in place and encapsulated in fill. For safety reasons, blasting would not occur at the same time as the mechanical salvaging or pile driving work.

Out-of-Water Demolition by Mechanical Means Only- Option 3

Option 3 is similar to Option 2, except that blasting would not be a means used for demolition. Option 3 is comprised of two phases: (1) construct a dike around the existing dock in the summer; and (2) demolish the dock in the winter. Total demolition activities for Phase 1 and Phase 2 would be anticipated to continue for the same time as Option 1 (i.e., 960 and 1,320 hours, respectively). Dike construction for Option 3 would follow the same process described in Option 2 above. All mechanical activities (e.g., chipping) would be done out-of-water with a 300 ft. land barrier between the dock and the water; therefore, this method of dock demolition is not likely to release noise into the marine environment above NMFS harassment threshold levels.

3.0 STATUS OF THE CRITICAL HABITAT

NMFS has determined the Cook Inlet beluga whale (*Delphinapterus leucas)* to be the only threatened or endangered species likely to occur in the action area. The Cook Inlet Distinct Population Segment (DPS) of beluga whale was listed as endangered under the ESA on October 22, 2008. Cook Inlet beluga whales are also designated as depleted and strategic under the Marine Mammal Protection Act. On December 2, 2009, NMFS published the Proposed Rule for Critical Habitat Designation for the Cook Inlet beluga whale as required by the ESA (74 FR 63080). On April 11, 2011, the Final Rule was published (76 FR 20180). This consultation considers the potential effects of the above described actions on the critical habitat by addressing the beluga whale survival criteria provided in the Final Rule, referred to as Primary Constituent Elements (PCEs) or Essential Features. NMFS has determined that these PCE's are essential to the conservation of the species and may require special management considerations or protection.

3.1.1 <u>Critical Habitat Types and Value</u>

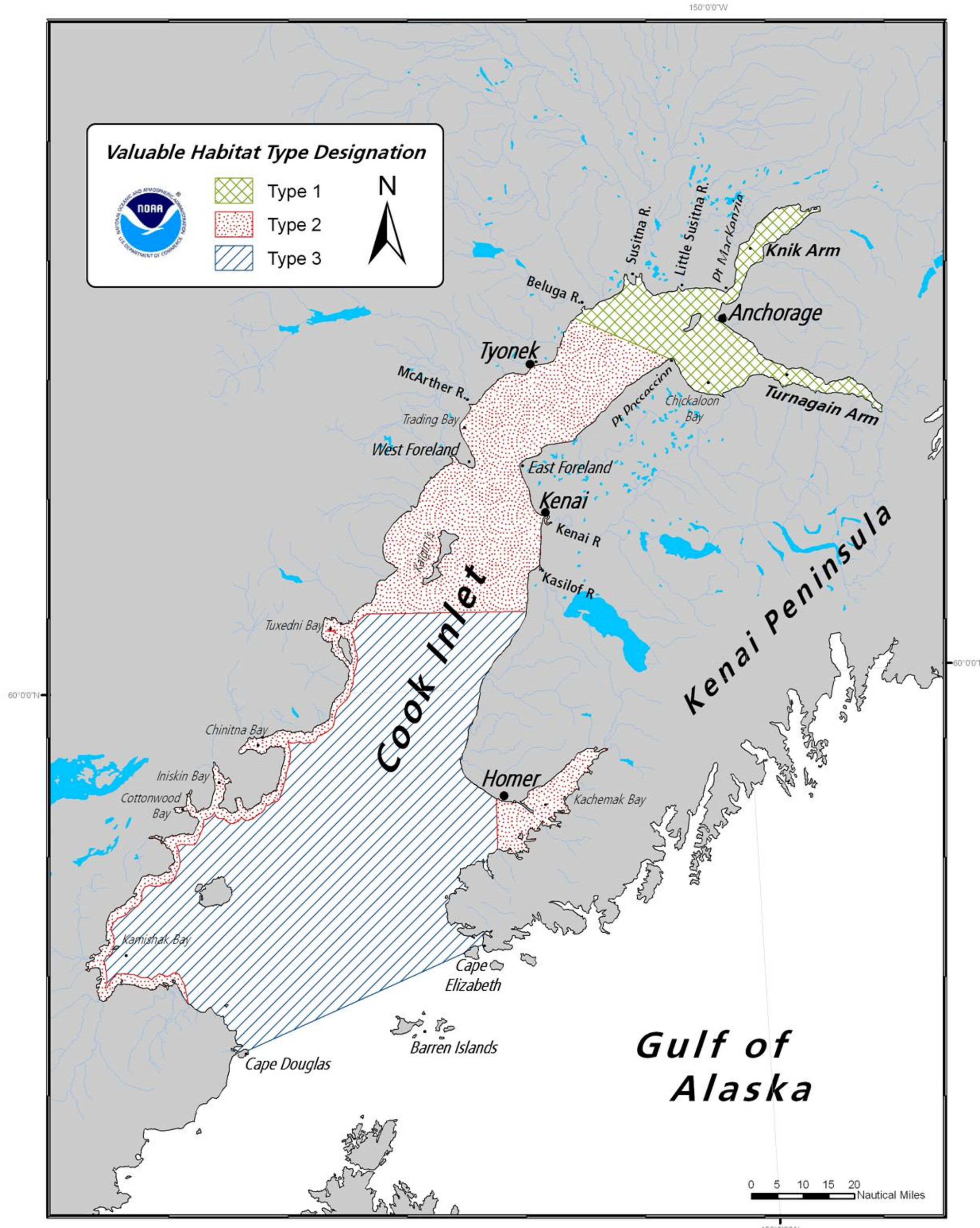
NMFS has characterized beluga whale habitats as part of the conservation strategy presented in the Conservation Plan (NMFS 2008). As a result, Cook Inlet has been stratified into three habitat regions based on differences in beluga use (Figure 4), with Type 1 habitat being the most valuable due to its intensive use by belugas from spring through fall for foraging and nursery habitat, and because it is in the upper Inlet where the greatest potential from anthropogenic impacts exists. Type 2 habitat includes areas with high fall and winter use, and a few isolated spring feeding areas. Type 3 habitat encompasses the remaining portions of the range of belugas within Cook Inlet. While Type 1 habitat is clearly the most valuable of the three types based on the frequency of use, the relative values of Types 2 and 3 habitats are difficult to distinguish because we have limited information about belugas' wintering habitats and which features in these two habitat types are the most important to belugas. We have, however, classified these two additional types separately based on observations of frequency of beluga use and for management purposes.

3.1.1.1 ***Type 1 Habitat***

Type 1 habitat encompasses all of Cook Inlet northeast of a line from three miles southwest of the Beluga River across to Point Possession. These areas are full of shallow tidal flats, river mouths or estuarine areas, and are important as foraging and calving habitats. These shallow areas may also provide for other biological needs, such as molting or escape from predators (Shelden et al. 2003). Type 1 habitat also has the highest concentrations of belugas from spring through fall as well as greatest potential for impact from anthropogenic threats. For these reasons, Type 1 habitat is considered the most valuable habitat type.

Many rivers in Type 1 habitat have large eulachon and salmon runs. Belugas visit Turnagain Arm in early spring traveling up to 20-Mile River and Placer Creeks, indicating the importance of eulachon runs for beluga feeding. Beluga use of upper Turnagain Arm decreases in the summer and then increases again in August through the fall, coinciding with the coho salmon run. Early spring (March to May) and fall (August to October) use of Knik Arm is confirmed by studies by Funk et al. (2005). Intensive summer feeding by belugas occurs in the Susitna delta area, Knik Arm and Turnagain Arm.

Figure 5 . Valuable habitat areas (Types 1, 2, 3) identified for Cook Inlet beluga whales.



Whales regularly move into and out of Knik Arm and the Susitna delta (Hobbs et al. 2000, Rugh et al. 2004). The combination of satellite telemetry data and long-term aerial survey data demonstrate beluga whales use Knik Arm 12 months of the year, often entering and leaving the Arm on a daily basis (Hobbs et al. 2005; Rugh et al. 2005, 2007). These surveys demonstrated intensive use of the Susitna delta area (from the Little Susitna River to Beluga River) and Chickaloon Bay (Turnagain Arm) with frequent large scale movements between the delta area, Knik Arm and Turnagain Arm. During annual aerial surveys conducted by NMML in June-July, up to 61 percent of the whales sighted in Cook Inlet were in Knik Arm (Rugh et al. 2000, 2005). The Chickaloon Bay area also appears to be used by belugas throughout the year.

Belugas are particularly vulnerable to impacts in Type 1 habitat due to their concentrated use and the biological importance of these areas. Because of their intensive use of this area (e.g., foraging, nursery, predator avoidance), activities that restrict or deter access to Type 1 habitat could reduce beluga calving success, impair their ability to secure prey, and increase their susceptibility to predation by killer whales. Projects that reduce anadromous fish runs could also negatively impact beluga foraging success during this time. Furthermore, the tendency for belugas to occur in high concentrations in Type 1 habitat predisposes them to harm from such events as oil spills.

All marine waters in the Port action area are categorized as Type 1 beluga whale essential habitat.

3.1.1.2 *Type 2 Habitat*

Type 2 habitat includes areas of less concentrated spring and summer beluga use, but known fall and winter use areas. It is located south of Type 1 habitat and north of a line at 60.2500 north latitude. It extends south along the west side of the Inlet following the tidal flats into Kamishak Bay to Douglas Reef, and includes an isolated section of Kachemak Bay (Figure 1).

Type 2 habitat is based on dispersed fall and winter feeding and transit areas in waters where whales typically occur in smaller densities or deeper waters. It includes both near and offshore areas of the mid and upper Inlet, and nearshore areas of the lower Inlet. Due to the roles of these areas as probable fall feeding areas, Type 2 habitat includes Tuxedni, Chinitna, and Kamishak Bays on the west coast and a portion of Kachemak Bay on the east coast. Winter aerial surveys (Hanson and Hubbard 1999) sighted belugas from the forelands south, with many observations around Kalgin Island. Based on tracking data, Hobbs et al. (2005) document important winter habitat concentration areas reaching south of Kalgin Island. Kachemak Bay has been included in Type 2 habitat because belugas have been regularly sighted at the Homer Spit and the head of Kachemak Bay, appearing during spring and fall of some years in groups of 10-20 individuals (Speckman and Piatt 2000). Belugas have also been common at Fox River flats, Muddy Bay, and the northwest shore of Kachemak Bay (Rugh et al. 2001, NMFS unpubl. data), sometimes remaining in Kachemak Bay all summer (Huntington 2000).

Dive behavior indicates beluga whales make relatively deeper dives (e.g., to the bottom) and are at the surface less frequently in Type 2 habitat, and hence are less frequently observed (Hobbs et al. 2005). It is believed these deep dives are associated with feeding during the fall and winter months (NMFS unpubl. data). The combination of deeper dives, consistent use of certain areas, and stomach content analyses indicate that belugas whales are actively feeding in these areas. Hence, deeper mid Inlet winter habitats may be important to the winter survival and recovery of Cook Inlet beluga whales.

3.1.1.3 ***Type 3 Habitat***

Type 3 habitat encompasses the remaining portions of Cook Inlet where belugas are infrequently observed, and areas which are not identified as Type 1 or 2 (e.g., not including the areas along the nearshore western portion of the Inlet). Type 3 habitat is south of 60.2500 north latitude and extends to a southern boundary line, approximately 85 km across, from Cape Douglas to Elizabeth Island.

In the past, with a larger Cook Inlet beluga population, early surveys and reports identified that belugas used these areas. Local knowledge and other historical evidence show that prior to the 1990s belugas were regularly seen in lower Cook Inlet waters, both nearshore and offshore (Rugh et al. 2000). This indicates that these areas were at one time important habitat and suggests that a recovered Cook Inlet beluga whale population may use these areas again.

3.1.2 Primary Constituent Elements

The following five Primary Constituent Elements (PCE) descriptions are from the final rule designating critical habitat for the Cook Inlet beluga whale. NMFS has established these five elements based on the best scientific data available on the ecology and natural history of the Cook Inlet beluga whale. These mandatory ecosystem determinants are essential to the conservation of the Cook Inlet beluga whale. All of the five PCE features discussed below are found or identified within the areas designated as critical habitat.

PCE # 1 - Intertidal and subtidal waters of Cook Inlet with depths <30 feet (9.1 m) Mean Lower Low Water (MLLW) and within 5 miles (8.0 km) of high and medium flow accumulation anadromous fish streams

Intertidal and subtidal ecosystems support important beluga feeding habitat because of their shallow depths and bottom structure, which act to concentrate prey and aid in feeding efficiency by belugas. The physical attributes of this PCE could be modified or lost through filling, dredging, channel re-alignment, dikes, and other structures.

PCE # 2 Primary prey species consisting of four (4) species of Pacific salmon (Chinook, sockeye, chum, and coho), Pacific eulachon, Pacific cod, walleye pollock, saffron cod, and yellowfin sole

Primary Prey Species were identified through research and as held by the traditional wisdom and knowledge of Alaska Natives who have participated in the subsistence hunting of these whales. Stomach analysis of Cook Inlet beluga whales has found these species constitute the majority of consumed prey by weight during summer/ice free periods.

PCE # 3 - The absence of toxins or other agents of a type or amount harmful to beluga whales

Cook Inlet is the most populated and industrialized region of the state. Its waters receive various pollutant loads through activities that include urban runoff, oil and gas activities (discharges of drilling muds and cuttings, production waters, deck drainage), municipal sewage treatment effluents, oil and other chemical spills, fish processing, and other regulated discharges.

The U.S. Environmental Protection Agency (EPA) regulates many of these pollutants, and may authorize certain discharges under their National Pollution Discharge Elimination System (Section 402 of the CWA).

PCE # 4 - Unrestricted passage within or between the critical habitat areas

Certain actions may have the effect of reducing or preventing beluga whales from freely accessing the habitat area necessary for their survival. Dams and causeways may create physical barriers, while noise and other disturbance or harassment might cause a behavior barrier, whereby the whales reach these areas with difficulty or, in a worst case, abandon the affected habitat areas altogether due to such stressors.

PCE # 5 - Absence of in-water noise at levels resulting in the abandonment of habitat by Cook Inlet beluga whales

There exists a large body of information on the effects of noise on beluga whales. Research on captive animals has found noise levels that result in temporary threshold shifts in beluga hearing. Based on this research and empirical data from belugas in the wild, NMFS has established in-water noise levels that define when these animals are harassed or injured.

NMFS considers the threshold for acoustic harassment to be 160 decibel (dB) referenced to one micropascal (re: 1 μPa) for impulsive sounds and 120 dB re: 1 μPa for continuous noise. No specific mechanisms presently exist to regulate in-water noise, other than secondarily through an associated authorization.

Because of the importance of the ability to use sound to Cook Inlet beluga whales, the absence of in-water noise at levels harmful to the whales is an essential feature that may require special management considerations or protection.

4.0 ENVIRONMENTAL BASELINE

The environmental baseline for this opinion discusses the current condition of the critical habitat in the action area, the factors responsible for that condition, and the conservation role of the critical habitat. By regulation the environmental baseline for opinions also includes the past and present impacts of all Federal, State, or private actions and other human activities in the action area, the anticipated impacts of all proposed Federal projects in the action area that have already undergone formal or early consultation, and the impact of state or private actions which are contemporaneous with the consultation in process (50 CFR §402.02). There are several natural and anthropogenic factors which have affected and may continue to affect the Cook Inlet beluga whale within the action area. These include predation, stranding, subsistence hunting, commercial fishing, habitat loss or alteration, and shipping and vessel traffic. After a brief review of current development in the project area, the environmental baseline of each of the 5 critical habitat PCEs is described below.

Development in Southcentral Alaska

The upper Cook Inlet region is the major population center of Alaska, with the 2009 population of the Anchorage Borough at 286,174, the Matanuska-Susitna Borough at 88,379, and the Kenai Peninsula Borough at 54,665 (U.S. Census Bureau). Many cities, villages, ports, airports, treatment plants, refineries, highways, and railroads are situated on or very near to Cook Inlet. Beluga whales are not uniformly distributed throughout the Inlet, but are predominantly found in nearshore waters. Where beluga whales must compete with people for use of nearshore habitats, coastline development (both construction and operation of a project) leads to the direct loss of habitat. Indirect alteration of habitat may occur due to bridges, boat traffic, in-water noise, and discharges that affect water quality. Most beluga habitat in Cook Inlet remains essentially intact; however, extensive sections of Turnagain Arm shoreline have been developed (e.g., rip rap and railroad construction), as have the shorelines of the Anchorage area.

Port facilities in Cook Inlet are found at Anchorage, Point Mackenzie, Tyonek, Drift River, Nikiski, Kenai, Anchor Point, and Homer. The Port of Anchorage is a deep draft facility, the State's largest seaport, and the main port of entry for southcentral and interior regions of the State. It exists along lower Knik Arm in an area that is heavily used by beluga whales. Contractor reports from LGL for the Port of Anchorage (Markowitz, memos to W.E. Humphries, August, September, October and November 2005) indicated that 79 percent of the whales sighted in the lower Knik Arm area entered the area immediately adjacent to the Port. The Point MacKenzie Port is presently configured as a barge port; however, plans call for a bulk loading facility with deep-draft capability. The Drift River facility is used primarily as a loading platform for shipments of crude oil. The docking facility there is connected to a shoreside tank farm and designed to accommodate tankers in the 150,000 deadweight-ton class. Nikiski is home to several privately owned docks (including those belonging to oil and gas companies such as Tesoro and Conoco Philips). Activity here includes the shipping and receiving of anhydrous ammonia, dry bulk urea, liquefied natural gas, petroleum products, sulfuric acid, caustic soda, and crude oil.

Even though over 90% of Knik Arm remains undeveloped, several planned or proposed projects have been recently identified in a relatively confined portion of lower Knik Arm (see list below). Knik Arm is an important feeding area for beluga whales during much of the summer and fall, especially upper Knik Arm. Whales ascend to upper Knik Arm on the flooding tide, feed on salmon, then fall back with the outgoing tide to hold in waters off and north of the Port of Anchorage. The primary concern for belugas is that development may restrict passage along Knik Arm.

The potential for impact on these whales is heightened by the following aspects of actual or potential Knik Arm development projects:

- Encroachment into lower Knik Arm from the east due to expansion of the Port of Anchorage.
- Encroachment into lower Knik Arm from the west due to expansion of Port MacKenzie.
- Increased dredging requirements with port expansions.
- Increased ship traffic due to expansion of both ports in lower Knik Arm; new boat launches; and possible operation of a commercial ferry.
- Increased in-water noise levels due to port construction, port operations and the associated increased vessel traffic.
- Increased need for vessel anchorage off both ports.
- Possible causeway construction to Fire Island.
- Possible construction of Knik Arm bridge.
- High in-water noise due to construction of causeway/bridge (e.g., pile driving, dredging).
- Increased water velocities in Knik Arm due to construction of causeway/bridge.
- Physical loss of habitat due to landfill.
- In-water noise and possible changes in water velocities associated with installing and operating 70-100 tidal energy generators in and around the entrance to Knik Arm.

Other potential development projects include Seward Highway improvements along Turnagain Arm; the south coastal trail extension in Anchorage; Chuitna Coal project with a marine terminal; Pebble Mine with a marine terminal in Iniskin Bay; Diamond Point granite rock quarry near Iliamna and Cottonwood Bays; and the placement of a submarine fiber optic cable by ACS from Nikiski to Anchorage.

4.1 PCE # 1 - Intertidal and subtidal waters of Cook Inlet with depths <30 feet (9.1 m) Mean Lower Low Water (MLLW) and within 5 miles (8.0 km) of high and medium flow accumulation anadromous fish streams

4.1.1 Cook Inlet Beluga Habitat Use

Belugas generally occur in shallow, coastal waters, and while some populations make long seasonal migrations, Cook Inlet belugas reside in Cook Inlet year round. Data from satellite tagged whales documented that Cook Inlet belugas concentrate in the upper Inlet at rivers and bays in the summer and fall, and then tend to disperse into deeper waters moving to mid Inlet locations in the winter. The Traditional Ecological Knowledge (TEK) of Alaska Natives and systematic aerial survey data document a contraction of the summer range of Cook Inlet belugas. While belugas were once abundant and frequently sighted in the lower Inlet during summer, they are now primarily concentrated in the upper Inlet. This constriction is likely a function of a reduced population seeking the highest quality habitat that offers the most abundant prey, most favorable feeding topography, the best calving areas, and the best protection from predation. An expanding population would likely use the lower Inlet more extensively.

While mating is assumed to occur sometime between late winter and early spring, there is little information available on the mating behavior of belugas. Most calving in Cook Inlet is assumed to occur from mid-May to mid-July (Calkins, 1983), although Native hunters have observed calving from April through August (Huntington, 2000). Alaska Natives described calving areas as the northern side of Kachemak Bay in April and May, off the mouths of the Beluga and Susitna rivers in May, and in Chickaloon Bay and Turnagain Arm during the summer (Huntington, 2000). The warmer waters from these freshwater sources may be important to newborn calves during their first few days of life (Katona et al., 1983; Calkins, 1989). Surveys conducted from 2005 to 2007 in the upper Inlet by LGL, Inc., documented neither localized calving areas nor a definitive calving season, since calves were encountered in all surveyed locations and months (April-October) (McGuire et al., 2008). The warmer, fresher coastal waters may also be important areas for belugas' seasonal summer molt.

4.1.1.1 *Calving Habitat*

The shallow waters of the upper Inlet may also play important roles in reproduction. Since newborn beluga whales do not have the thick blubber layer of adults, they benefit from the warmer water temperatures in the shallow tidal flats areas where fresh water empties into the Inlet, and hence it is likely these regions are used as nursery areas. TEK of Alaska Natives report that the mouths of the Beluga and Susitna Rivers, as well as Chickaloon Bay and Turnagain Arm, are calving and nursery areas for beluga whales (Huntington 2000).

Knik Arm is also used extensively in the summer and fall by cow/calf pairs. Surveys by LGL (Funk et al. 2005) noted a relatively high representation of calves in the uppermost part of Knik Arm. The mouth of Knik Arm has been reported to be transited in the summer and fall by cow/calf pairs (Cornick and Kendall 2008), presumably moving into the upper reaches of the Arm. McGuire et al. (2008) photographically identified 37 distinct belugas with calves in the upper Inlet during 2005-2007. However, because calves were seen in all areas of their study (Susitna River Delta, Knik Arm, Chickaloon Bay/Southeast Fire Island, and Turnagain Arm), they were unable to determine distinct calving areas (McGuire et al. 2008).

4.2 PCE # 2 Primary prey species consisting of four (4) species of Pacific salmon (Chinook, sockeye, chum, and coho), Pacific eulachon, Pacific cod, walleye pollock, saffron cod, and yellowfin sole

Cook Inlet belugas are opportunistic feeders and feed on a wide variety of prey species, focusing on specific species when they are seasonally abundant. Eulachon (locally referred to as hooligan or candlefish) is an important early spring food resource for beluga whales in Cook Inlet, as evidenced by the stomach of a beluga hunted near the Susitna River in April 1998 that was filled exclusively with eulachon (NMFS unpubl. data). These fish first enter the upper Inlet in April, with two major spawning migrations occurring in the Susitna River in May and July. The early run is estimated at several hundred thousand fish and the later run at several million (Calkins, 1989).

In the summer, as eulachon runs begin to diminish, belugas rely heavily on several species of salmon as a primary prey resource. Beluga whale hunters in Cook Inlet reported one whale having 19 adult king salmon in its stomach (Huntington, 2000). NMFS (unpubl. data) reported a 14 foot 3 inch (4.3 m) male with 12 coho salmon, totaling 61.5 lbs (27.9 kg), in its stomach.

The seasonal availability of energy-rich prey such as eulachon, which may contain as much as 21 percent oil (Payne et al., 1999), and salmon are very important to the energetics of belugas (Abookire and Piatt, 2005; Litzow et al., 2006). Native hunters in Cook Inlet have stated that beluga whale blubber is thicker after the whales have fed on eulachon than in the early spring prior to eulachon runs. In spring, the whales were described as thin with blubber only 2-3 inches (5-8 cm) thick compared to the fall when the blubber may be up to 1 ft (30 cm) thick (Huntington, 2000). Eating such fatty prey and building up fat reserves throughout spring and summer may allow beluga whales to sustain themselves during periods of reduced prey availability (e.g., winter) or other adverse impacts by using the energy stored in their blubber to meet metabolic needs. Mature females have additional energy requirements. The known presence of pregnant females in late March, April, and June (Mahoney and Shelden, 2000; Vos and Shelden, 2005) suggests breeding may be occurring in late spring into early summer. Calves depend on their mother’s milk as their sole source of nutrition, and lactation lasts up to 23 months (Braham, 1984), though young whales begin to consume prey as early as 12 months of age (Burns and Seaman, 1986). Therefore, the summer feeding period is critical to pregnant and lactating belugas. Summertime prey availability is difficult to quantify. Known salmon escapement numbers and commercial harvests have fluctuated widely throughout the last 40 years; however, samples of harvested and stranded beluga whales have shown consistent summer blubber thicknesses.

In the fall, as anadromous fish runs begin to decline, belugas again return to consume the fish species found in nearshore bays and estuaries. This includes cod species as well as other bottom-dwellers, such as Pacific staghorn sculpin, and flatfishes, such as starry flounder and yellowfin sole. This change in diet in the fall is consistent with other beluga populations known to feed on a wide variety of food. Flatfish are typically found in very shallow water and estuaries during the warm summer months and move into deeper water in the winter as coastal water temperatures cool (though some may occur in deep water year-round).

The available information indicates that Cook Inlet belugas move throughout much of the Inlet in the winter months. They concentrate in deeper waters in mid Inlet past Kalgin Island, with occasional forays into the upper Inlet, including the upper ends of Knik and Turnagain Arms. While the beluga whales move into the mid to lower Inlet during the winter, ice cover does not appear to limit their movements. Their winter distribution does not appear to be associated with river mouths, as it is during the warmer months. The spatial dispersal and diversity of winter prey likely influence the wider beluga winter range throughout the mid Inlet.

There is obvious and repeated use of certain habitats by Cook Inlet beluga whales. Intensive aerial abundance surveys conducted in June and July since 1993 have consistently documented high use of Knik Arm, Turnagain Arm, Chickaloon Bay and the Susitna River delta areas of the upper Inlet. The high use of these areas by belugas is further supported by data from satellite tagging studies.

4.2.1.1 ***Feeding Habitat***

Spring prey of Cook Inlet beluga whales includes eulachon and gadids (saffron cod, Pacific cod, and walleye Pollock). Eulachon first enter the upper Inlet in April, with two major spawning migrations occurring in the Susitna River in May and July. Gadids prefer shallow coastal waters and are found near and in rivers within the zone of tidal influence (Morrow 1980, Cohen et al. 1990). Adult cod exhibit seasonal movements; saffron cod move offshore during the summer for feeding while Pacific cod migrate to shallower water in the spring to feed (Cohen et al. 1990). Alaskan natives also describe Cook Inlet belugas as feeding on anadromous steelhead trout, freshwater fish such as whitefish, northern pike, and grayling (Huntington 2000), and other marine fish such as tomcod during the spring (Fay et al. 1984). These species are also abundant in the Susitna River system.

Five Pacific salmon species (Chinook, pink, coho, sockeye, and chum) spawn in rivers throughout Cook Inlet in the summer (Moulton 1997, Moore et al. 2000). During this time, anadromous smolt and adult fish concentrate at river mouths and adjacent intertidal mudflats to adjust to changing salinities between salt and fresh waters (ADFG 2004). The coincident occurrence and concentration of beluga whales and adult salmon returns to waters of the upper Inlet from late spring throughout the summer indicates these are likely feeding areas.

In upper Cook Inlet, beluga whales concentrate offshore from several important salmon streams and appear to use a feeding strategy which takes advantage of the bathymetry in the area. The channels formed by the river mouths and the shallow waters act as a funnel for salmon as they move past waiting belugas. Dense concentrations of prey may be essential to beluga whale foraging. Hazard (1988) hypothesized that beluga whales were more successful feeding in rivers where prey were concentrated than in bays where prey were dispersed. Fried et al. (1979) noted that beluga whales in Bristol Bay fed at the mouth of the Snake River, where salmon runs are smaller than in other rivers in Bristol Bay. However, the mouth of the Snake River is shallower, and hence may concentrate prey. Research on beluga whales in Bristol Bay suggests these whales preferred certain streams for feeding based on the configuration of the stream channel (Frost et al. 1983). This study theorized beluga whales' feeding efficiencies improve in relatively shallow channels where fish are confined or concentrated.

Because beluga whales do not always feed at the streams with the highest runs of fish, bathymetry and fish density may be more important than sheer numbers of fish in their feeding success. If true, this would imply Cook Inlet beluga whales do not simply go where the fish are, but may be partially dependent on particular feeding habitats with appropriate topography. Beluga whales exhibit high site fidelity and may persist in an area with fluctuating fish runs or may tolerate certain levels of disturbance from boats or other anthropogenic activities in order to feed. On the other hand, it is apparent the movements and feeding distribution of beluga whales are not simply explained by when and where the most fish are. For example, beluga whales today are seen less frequently at the mouth of the Kenai River, despite high salmon returns to the river.

In the fall, as anadromous fish runs begin to decline, belugas again return to consume the fish species found in nearshore bays and estuaries. In the winter, Cook Inlet beluga whales concentrate in deeper waters in mid Inlet past Kalgin Island and make deep feeding dives, likely feeding on such prey species as flatfish, cod, sculpin, and pollock. The narrowing of the Inlet in this area and the presence of Kalgin Island just south of the forelands may cause upwelling and eddies that concentrate nutrients or act as a "still-water shelter area" for migrating anadromous fishes such as salmon, eulachon, and smelt, which are known beluga prey species. The Kalgin Island area may also be rich in biological productivity; for instance, crustaceans are known to occur south of the island (Calkins 1983). The Kalgin Island area may serve as a late-winter staging area for eulachon prior to migration to their natal streams in upper Cook Inlet. If these fish and crustaceans generally are present in this area during late winter, they may be an important food source for belugas in the winter. Saffron cod migrate inshore during winter for spawning (Cohen et al. 1990). Pacific cod move to progressively deeper water as they age, spawning in deeper, offshore waters in winter (Cohen et al. 1990). Belugas will also occasionally travel into the upper Inlet in winter, including the upper ends of Knik and Turnagain Arms.

4.2.1.2 ***Reduction of Prey***

Aside from direct mortality and injury from fishing activities, commercial fisheries may compete with beluga whales in Cook Inlet for salmon and other prey species. There is strong indication these whales are dependent on access to relatively dense concentrations of high value prey throughout the summer months. Native hunters have often stated that beluga whales appear thin in early spring (due to utilizing the fat in their blubber layer over winter), and tend to sink rather than float when struck. Any diminishment in the ability of beluga whales to reach or utilize spring/summer feeding habitat, or any reductions in the amount of prey available, may impact the energetics of these animals and delay recovery.

The current salmon management plan for the State of Alaska oversees Inlet fisheries in the lower, middle, and northern districts of the Inlet. Most of these fisheries occur “upstream” of the river mouths and estuaries where beluga whales typically feed. Whether the escapement into these rivers, having passed the gauntlet of the commercial fisheries, is sufficient for the well being of Cook Inlet beluga whales is unknown. Furthermore, the amount of fish required to sustain this population is unknown. Additional research, such as continued stomach and fatty acid analyses, may shed more light on feeding and prey requirements for beluga whales.

At this time, it is unknown whether competition with commercial fishing operations for prey resources is having an appreciable effect on Cook Inlet beluga whales.

4.3 PCE # 3 - The absence of toxins or other agents of a type or amount harmful to beluga whales

4.3.1.1 *Pollution*

Contaminants are a concern for beluga whale health and subsistence use (Becker et al. 2000). The principal sources of pollution in the marine environment are: 1) discharges from industrial activities that do not enter municipal treatment systems; 2) discharges from municipal wastewater treatment systems; 3) runoff from urban, mining, and agricultural areas; and 4) accidental spills or discharges of petroleum and other products (Moore et al. 2000).

Since 1992, tissues from Cook Inlet beluga whales have been collected from subsistence harvested and stranded belugas and analyzed for contaminants as part of the Alaska Marine Mammal Tissue Archival Program. These samples were compared to samples taken from beluga whales in two Arctic Alaska locations (Point Hope and Point Lay), Greenland, Arctic Canada, and the Saint Lawrence estuary in eastern Canada (Becker et al. 2000). Tissues were analyzed for polychlorinated biphenyls (PCBs), chlorinated pesticides (such as DDT), and heavy metals. PCB’s and DDT are byproducts of agricultural and industrial activities and may impair marine mammal health and reproductive abilities. Arctic and Cook Inlet beluga whales had much lower concentrations of PCBs and DDT than the Saint Lawrence animals. When compared to the Arctic Alaska samples, Cook Inlet beluga whales had about one-half the concentrations of total PCBs and total DDT.

Also examined were concentrations of various substances stored in the liver. Cadmium and mercury were lower in the Cook Inlet population than in the Arctic Alaska populations, while levels of methylmercury were similar to other Arctic Alaska populations. However, copper levels were two to three times higher in the Cook Inlet animals than in the Arctic Alaska animals and similar to the Hudson Bay animals.

Becker et al. (2000) also compared tissue levels of total PCBs, total DDT, and a variety of other chemicals in these beluga whale stocks and found that Cook Inlet beluga whales had the lowest concentrations of all. The effects of lower concentrations of PCBs and chlorinated pesticides on animal health may be of less significance for the Cook Inlet animals than for other beluga whale populations. Becker et al. (2000) concluded that little is known about the role of multiple stressors in animal health and that future research should examine their interaction and effects on population recruitment for a declining population, such as the beluga whale in Cook Inlet.

Chemical analysis of dredging sediments in 2003 found that pesticides, PCB's, and petroleum hydrocarbons were below detection limits, while levels of arsenic, barium, chromium, and lead were well below management levels (USCOE 2003). Cadmium, mercury, selenium, and silver were not detected. In general, it appears Cook Inlet beluga whales have lower levels of contaminants stored in their bodies than do other populations of belugas. However, the impacts of contaminants on belugas in Cook Inlet is unknown.

4.3.1.2 ***Dredging***

Dredging along coastal waterways has been identified as a concern with respect to the Saint Lawrence beluga whales (DFO 1995). There, dredging of up to 600,000 cubic meters of sediments re-suspended contaminants into the water column and seriously impacted the belugas. The Saint Lawrence beluga whale recovery plan contains recommendations to reduce the amount of dredging and to develop more environmentally sound dredging techniques. While the volume of dredging in Cook Inlet is comparable to St. Lawrence (more than 844,000 cubic yards in 2003 at the Port of Anchorage), the material does not appear to contain harmful levels of contaminants.

4.3.1.3 ***Wastewater Treatment***

Ten communities currently discharge treated municipal wastes into Cook Inlet. Wastewaters entering these plants may contain a variety of organic and inorganic pollutants, metals, nutrients, sediments, bacteria and viruses, and other emerging pollutants of concern. Wastewater from the Municipality of Anchorage, Nanwalek, Port Graham, Seldovia, and Tyonek receive only primary treatment, while wastewaters from Eagle River, Girdwood, Homer, Kenai, and Palmer receive secondary treatment (NOAA 2003). Primary treatment means that only materials that can easily be collected from the raw wastewater (such as fats, oils, greases, sand, gravel, rocks, floating objects, and human wastes) are removed, usually through mechanical means. Wastewater undergoing secondary treatment is further treated to substantially degrade the biological content of the sewage (such as in human and food wastes).

Little is known about emerging pollutants of concern (EPOCs) and their effects on belugas in Cook Inlet. EPOCs include endocrine disruptors (substances that interfere with the functions of hormones), pharmaceuticals, personal care products, and prions (proteins that may cause an infection), amongst other agents that are found in wastewater and biosolids. The potential impacts on beluga whales from pollutants and EPOCs in wastewater entering Cook Inlet cannot be defined at this time.

4.3.1.4 ***Stormwater Runoff***

The Municipality of Anchorage (MOA) operates under a NPDES storm water permit to discharge storm water into Cook Inlet. The MOA's NPDES storm water permit (AKS05255) is a five-year term permit to discharge storm water to Cook Inlet, and is issued jointly to the MOA and the Alaska Department of Transportation and Public Facilities (DOT) by the U.S. Region 10 EPA. The MOA Watershed Management Program (2006) report addresses coordination and education, land use policy, new development management, construction site runoff management, flood plain management, street maintenance, and best management practices. Some of the management practices addressed included: pollutant sources and controls (includes street deicer and snow disposal guidance), illicit discharge management, industrial discharge management, pesticides management, pathogens management, watershed mapping, hydrology, water quality, ecology and bioassessment, and watershed characterization. There has been no comprehensive study or analysis to determine if stormwater discharge has had a detrimental effect on beluga whales. The State of Alaska has acquired permitting authority under the Clean Water Act, and future permits for this discharge will be issued under the new Alaska Pollutant Discharge Elimination System.

4.3.1.5 *Airport Deicing*

Deicing and anti-icing operations occur from October through May at many airports in and around Cook Inlet, especially Stevens International Airport, Merril Field, Elmendorf Air Force Base, Lake Hood and Lake Spenard. Deicing and anti-icing of aircraft and airfield surfaces are required by the Federal Aviation Administration (FAA) to ensure the safety of passengers. Depending on the application, deicing activities utilize different chemicals. For instance, ethylene glycol and propylene glycol are used on aircraft for anti-icing and deicing purposes, whereas potassium acetate and urea are used to deice tarmacs and runways. All the deicing materials or their break down products eventually make it to the Inlet. The amount the deicing materials break down prior to discharging into Cook Inlet is not clearly known at this time. The potential impacts on beluga whales from deicing agents entering Cook Inlet have not been analyzed and cannot be determined at this time.

4.3.1.6 *Ballast Water Discharges*

Ballast water releases in Cook Inlet are a concern because they can potentially release pollutants and non-indigenous organisms into the ecosystem. It is a recognized worldwide problem that aquatic organisms picked up in ship ballast water, transported to foreign lands, and dumped into non-native habitats, are responsible for significant ecological and economic perturbations costing billions of dollars. The effect of invasive species from such discharges on the Cook Inlet ecosystem is unknown.

4.3.1.7 *Military Training at Eagle River Flats*

The Eagle River Flats is a 2,140 acre estuarine salt marsh located at the mouth of Eagle River on Fort Richardson Army Post. Glacially-fed Eagle River flows through the flats before discharging into Eagle Bay of Knik Arm in upper Cook Inlet. Anthropogenic influences on the flats include military training, both historic (Army artillery impact area since 1949) and current (winter firing of artillery into flats) as well as activities associated with the remediation of white phosphorus left from artillery shell residues. The U.S. Army is currently assessing whether this training site is having an adverse affect on Cook Inlet belugas.

4.3.1.8 ***Oil and Gas***

Much of the Cook Inlet region overlies reserves of oil and natural gas. Upper Cook Inlet and the Kenai Peninsula have an association with the petroleum industry that dates back to the 1950s. There are 16 platforms in upper Cook Inlet, 12 of which are active today. Oil spills are a significant concern with regard to offshore oil and gas production, petroleum product shipment, and general vessel traffic. It is difficult to accurately predict the effects of oil on Cook Inlet beluga whales (or any cetacean) because of a lack of data on the metabolism of this species. Nevertheless, some generalizations can be made regarding impacts of oil on individual whales based on present knowledge. Oil spills that occurred while Cook Inlet beluga whales were present could result in skin contact with the oil, respiratory distress from hydrocarbon vapors, contaminated food sources, and displacement from feeding areas. Actual impacts would depend on the extent and duration of contact, and the characteristics (age) of the oil. Cook Inlet beluga whales could be affected through residual oil from a spill even if they were not present during the oil spill. Also, response actions may impact whales due to intensive vessel traffic or specific technologies, such as *in situ* burning of oil.

If an oil spill were concentrated in an area that is used by large numbers of belugas, it is possible that a whale could inhale enough vapors from a fresh spill to affect its health. Contaminated food sources and displacement from feeding areas also may occur as a result of an oil spill.

4.4 PCE # 4 - Unrestricted passage within or between the critical habitat areas

4.4.1.1 ***Distribution and Movements***

Belugas remain year-round in Cook Inlet, but demonstrate seasonal movement within the Inlet. Both scientific research and native hunter TEK say beluga whales may move hundreds of miles to exploit changes in prey distribution (i.e., belugas follow their prey). For instance, the movements of belugas within upper Cook Inlet coincide with anadromous fish migrations; they often aggregate near the mouths of rivers and streams where salmon runs occur.

Belugas concentrate in upper Cook Inlet at rivers and bays in summer. The timing and location of eulachon and salmon runs have a strong influence on belugas' spring and summer movements. Beluga whales are regularly sighted in the upper Inlet beginning in late April or early May, coinciding with eulachon runs in the Susitna River and Twenty Mile River in Turnagain Arm. In Knik Arm, beluga whales are generally observed arriving in May, but tend to concentrate near the Susitna Delta in summer (Figure 4), feeding on the various salmon runs.

In addition to frequenting the Susitna and Little Susitna rivers and corresponding flats throughout the summer, belugas also use the smaller streams along the west side of the Inlet, following first the eulachon and king salmon runs and later in the summer the coho salmon runs. Data from 14 satellite tagged beluga whales, in conjunction with TEK, indicate that during late summer and fall belugas use the streams on the west side of Cook Inlet from the Susitna River delta south to Chinitna Bay. Native hunters report that beluga whales once reached Beluga Lake, 56 km (35 miles) from the Beluga River, and that beluga whales are often seen well upstream in the Kenai and Little Susitna rivers, presumably following the fish migrations (Huntington 2000).

Belugas may remain in the upper Inlet into the fall, but appear to move west and south, coinciding with the coho run. Beluga whales regularly gather in Eagle Bay and elsewhere on the east side of Knik Arm, and sometimes in Goose Bay on the west side of Knik Arm.

During winter months, these whales concentrate in deeper waters in mid Inlet past Kalgin Island, with occasional forays into the upper Inlet, including the upper ends of Knik and Turnagain Arms. Winter distribution does not appear to be associated with river mouths, as it is during the warmer months. The spatial dispersal and diversity of winter prey likely influences the wider beluga winter range throughout the mid Inlet.

Cook Inlet belugas have been seen moving with the tides, especially in Turnagain and Knik Arms where tides are extreme and mudflats are extensive. Cook Inlet's semi-diurnal tides facilitate movements by belugas on a daily or twice daily basis into feeding and nursery areas (Hobbs et al. 2005). Access to these areas and to corridors between these areas is important. TEK suggests that belugas move in and out of the upper Inlet with the tides from April through November and concentrate at river mouths and tidal flat areas (Huntington2000).

4.4.1.2 *Observations within the Action Area*

The lower reaches of Knik Arm and the action area are regularly used by Cook Inlet belugas. The most common activities observed are traveling and feeding, with the beluga whales exhibiting distinctive seasonal and tidal patterns. The highest degree of use occurs within and adjacent to the Port; in some years nearly 80 percent of the whales sighted in the lower Knik Arm entered the MTR project footprint (Markowitz and McGuire 2007). Belugas whales also use known and potential foraging habitat on the western shore, while the central regions of the project action area are the least heavily used (Prevel Ramos et al. 2006; Markowitz and McGuire 2007; Cornick and Kendall 2008; Cornick and Saxon-Kendall 2009).

Fish studies in 2004 and 2005 (Pentec 2005a) determined that the Port area is used as migrating, rearing, and foraging habitat for fish, and one explanation for the repeated observation of beluga whales within the MTR Project footprint is the presence of an eddy during ebb tide that may serve to concentrate prey (Ebersole and Raad 2004).

Cow/calf pairs are regularly observed throughout the project area, but the area is not known to be calving habitat. Group sizes have ranged from 1 to 57 individuals, and calves are normally present in larger groups (>9) (Cornick and Saxon-Kendall 2009).

4.4.1.3 ***Seasonal Patterns***

Beluga whales appear to use the Project action area primarily for transit and foraging, following prey north into Knik Arm in late summer and remaining in the Knik Arm vicinity until ice cover forces them to leave in the late fall (Cornick and Saxon-Kendall 2009). Very few beluga whales have been observed in the project area during the months of June and July, with sightings increasing in mid-August. During this period, beluga whales are commonly seen at the mouth of Ship Creek where they feed on salmon and other fish, and also in the vicinity of the Port alongside docked ships and within 300 feet of the docks (Great Land Trust 2000; Blackwell and Greene 2002; NMML 2004). Sightings decrease slightly in September and early October, then pick up again at the end of October and into November as whales are forced out of Knik Arm due to the intrusion of ice. Beluga whales appear to remain in Knik Arm as long as ice-free conditions persist, as this habitat could provide increased foraging opportunity before winter, increased protection for calves from predation, or both (Cornick and Saxon-Kendall 2009).

4.4.1.4 ***Tidal Patterns***

Beluga whales have been observed entering Knik Arm on flood tides and exiting on ebb tides (Cornick and Saxon-Kendall 2009), with very few whales observed at high tide. The whales tend to stay close to shore, following the tide through the narrows within 1 km of either shoreline. Whales ascend to upper Knik Arm on the flooding tide, feed on salmon, then fall back with the outgoing tide to hold in waters north of the Port. Whales moving up Knik Arm tend to prefer the eastern shoreline, in the immediate vicinity of the Port, while whales moving out of Knik Arm tend to hug the western shoreline (Cornick and Saxon-Kendall 2009).

Beluga whales have been monitored within lower Knik Arm in association with the port expansion project and other efforts. These observations are described, and present detail regarding belugas within the action area.

4.4.1.5 ***Knik Arm Bridge and Toll Authority (KABATA) 2004-2005 Baseline Study***

To assist in the evaluation of the potential impact of a proposed bridge crossing of Knik Arm north of Cairn Point, KABATA initiated a study to collect baseline environmental data on beluga whale activity and the ecology of Knik Arm (Funk et al. 2005). Boat and land-based observations were conducted in Knik Arm from July 2004 through July 2005. Land-based observations were conducted from nine stations along the shore of Knik Arm. The three primary stations were located at Cairn Point, Point Woronzof, and Birchwood. The majority of the beluga whales were observed north of Cairn Point, and temporal use of Knik Arm was related to tide height. During the study period, most beluga whales stayed in the upper portion of Knik Arm north of Cairn Point. Approximately 90 percent of observations occurred during the months of August through November, and only during this time were whales consistently sighted in Knik Arm. The relatively low number of sightings throughout the rest of the year suggested the whales were using other portions of Cook Inlet. In addition, relatively few beluga whales were sighted in the spring and early to mid-summer months. Beluga whales predominantly frequented

Eagle Bay (mouth of Eagle River), Eklutna, and the stretch of coastline in between, particularly when they were present in greater numbers.

4.4.1.6 *POA Marine Mammal Monitoring Program 2005-2008*

The POA has conducted a NMFS-approved yearly monitoring program for beluga whales and other marine mammals focused on the Port area since 2005. The monitoring and data collection efforts provided real-time information to the shore-based construction observation/mitigation team at the Port. The observers recorded the location of belugas (and a few harbor seals) on a grid map according to the distance of the animals from the construction site. The observers also recorded the number of animals per sighting, sex/age composition of the group, and their behavior. Data on beluga whale sighting rates, grouping, behavior, and movement indicate the Port area is typically visited for short periods of time by lone whales or small groups of whales. They are observed most often at low tide in the fall, peaking in late August to early September. Although groups with calves have been observed to enter the Port area, the area is not considered a nursery area.

Although the POA scientific monitoring studies indicate that the area is not used frequently by many beluga whales, it is apparently used as foraging habitat by whales traveling between lower and upper Knik Arm. In all years, diving and traveling were the most common behaviors observed, with many instances of confirmed feeding. Sighting rates at the Port range from 0.2 to 0.4 whales per hour (Prevel Ramos et al. 2006; Markowitz and McGuire 2007), as compared to 3 to 5 whales per hour at Eklutna, 20 to 30 whales per hour at Birchwood, and 3 to 8 whales per hour at Cairn Point (Funk et al. 2005) indicating that these areas are of higher use than the Port. In 2007 and 2008, beluga whales have been observed to enter the project footprint while construction activities were taking place, including pile driving and dredging.

4.4.1.7 *Vessel Traffic*

Most of Cook Inlet is navigable and used by various classes of water craft which pose the threat of ship strikes to beluga whales. While ship strikes have not been definitively confirmed in a Cook Inlet beluga whale death, in October 2007 a beluga washed ashore dead with “wide, blunt trauma along the right side of the thorax” (NMFS unpubl. data), suggesting a ship strike was the cause of the injury.

Port facilities in Cook Inlet are found at Anchorage, Point MacKenzie, Tyonek, Drift River, Nikiski, Kenai, Anchor Point, and Homer. Commercial shipping occurs year round, with containerships transiting between the Seattle/Puget Sound areas and Anchorage. Other commercial shipping includes bulk cargo freighters and tankers. Various commercial fishing vessels operate throughout Cook Inlet, with some very intensive use areas associated with salmon and herring fisheries. Sport fishing and recreational vessels are also common, especially within Kachemak Bay, along the eastern shoreline of the lower Kenai Peninsula, and between Anchorage and several popular fishing streams which enter the upper Inlet. Several improved and unimproved small boat launches exist along the shores of upper Cook Inlet. The MOA maintains a ramp and float system for small watercraft near Ship Creek. Other launches are near the Knik River bridge and at old Knik. Currently, with the exception of the Fire Island Shoals and the Port of Anchorage, no large-vessel routes or port facilities in Cook Inlet occur in high value beluga whale habitats.

Due to their slower speed and straight line movement, ship strikes from large vessels are not expected to pose a significant threat to Cook Inlet beluga whales. However, smaller boats that travel at high speed and change direction often present a greater threat. In Cook Inlet, the presence of beluga whales near river mouths predisposes them to strikes by high speed water craft associated with sport and commercial fishing and general recreation. The mouths of the Susitna and Little Susitna Rivers in particular are areas where small vessel traffic and whales commonly occur. Vessels that operate near these whales have an increased probability of striking a whale, as evidenced by observations of Cook Inlet beluga whales with propeller scars (Burek 1999).

Vessels associated with the Port of Anchorage are primarily large ships, tankers, and tugs. Sound generated by such vessels may be very loud, but occurs at low frequencies (5 to 500 Hz). While large ships generate some broadband noise, the majority of this sound energy would fall below the hearing range of beluga whales and is not expected to elicit behavioral reaction. There is concern, however, for very loud transient sounds such as may occur when placing containers onto the deck of a large cargo ship, and for operation of fathometers and similar devices operating at frequencies that might mask beluga calls.

4.4.1.8 ***Tourism and Whale Watching***

Tourism is a growing component of the State and regional economies, and wildlife viewing is an important part of this use. Visitors highly value the opportunity to view the region's fish and wildlife, and opportunities to view the beluga whale are especially valuable due to their uniqueness. Beluga whales are very common to upper Cook Inlet and typically occur in fairly large groups. Because these waters are easily accessible from Anchorage, this presents an excellent opportunity for whale watching. Whale watching is not, in itself, harmful to whales. It presents concerns due to vessel noise, proximity to the whales (approach distance and harassment), and intrusion into important whale habitats. Concern is warranted for whale watching operations that approach beluga whales close enough to harass or that enter into confined or important habitat areas. Currently no commercial whale watching operations exist in upper Cook Inlet, and we have no information suggesting such activity might occur in the near future.

4.5 PCE # 5 - Absence of in-water noise at levels resulting in the abandonment of habitat by Cook Inlet beluga whales

4.5.1.1 *Noise*

Beluga whales are known to be among the most adept users of sound of all marine mammals, and use sound rather than sight for many important functions. This is not surprising when considering that beluga whales are often found in turbid waters and live in northern latitudes where darkness extends over many months. Beluga whales use sound to communicate, locate prey, and navigate, and may make different sounds in response to different stimuli. Beluga whales produce high frequency sounds which they use as a type of sonar for finding and pursuing prey, and likely for navigating through ice-laden waters.

Beluga whales have a well-developed sense of hearing and echolocation. These whales hear over a large range of frequencies, from about 40-75 Hertz (Hz) to 30-100 kiloHertz (kHz) (Richardson 1995), although their hearing is most acute at middle frequencies between about 10 kHz and 75 kHz (Fay 1988). Most sound reception takes place through the lower jaw which is hollow at its base and filled with fatty oil. Sounds are received and conducted through the lower jaw to the middle and inner ears, then to the brain. Complementing their excellent hearing is the fact that beluga whales have one of the most diverse vocal repertoires of all marine mammals. They are capable of making a variety of vocalizations, including whistles, buzzes, groans, roars, trills, etc., which lead to their nickname as sea canaries.

In Cook Inlet, beluga whales must compete acoustically with natural and anthropogenic sounds. Man-made sources of noise in Cook Inlet include large and small vessels, aircraft, oil and gas drilling, marine seismic surveys, pile driving, and dredging. The effects of man-made noise on beluga whales and associated increased “background” noises may be similar to our reduced visibilities when confronted with heavy fog or darkness. These effects depend on several factors including the intensity, frequency and duration of the noise, the location and behavior of the whale, and the acoustic nature of the environment. High frequency noise diminishes more rapidly than lower frequency noises. Sound also dissipates more rapidly in shallow waters and over soft bottoms (sand and mud). Much of upper Cook Inlet is characterized by its shallow depth, sand/mud bottoms, and high background noise from currents and glacial silt (Blackwell and Greene 2002) thereby making it a poor acoustic environment.

Research on captive animals has found beluga whales hear best at relatively high frequencies, between 10 and 100 kHz (Blackwell and Greene 2002), which is generally above the level of much industrial noise. The beluga whales’ hearing falls off rapidly above 100 kHz. However, beluga whales may hear sounds as low as 40-75 Hz, although this noise would have to be very loud. Anthropogenic noise above ambient levels and within the same frequencies used by belugas may mask communication between these animals. At louder levels, noise may result in disturbance and harassment, or cause temporary or permanent damage to the whales’ hearing.

Although captive beluga whales have provided some insight into beluga hearing and the levels of noise that might damage their hearing capabilities, much less information is available on how noise might impact beluga whales behaviorally in the wild. Alaska Native beluga whale hunters with CIMMC have said that the Cook Inlet beluga whales are very sensitive to boat noise, and will leave areas subjected to high use. Native hunters near Kotzebue Sound report that beluga whales in that region abandoned areas in which fishing vessels were common (NMFS unpubl. data). In the Canadian high Arctic, beluga whales were observed to react to ice-breaking ships at distances of more than 80 km, showing strong avoidance, apparent alarm calls, and displacement (Finley et al. 1990). The whales' activity patterns were apparently affected for up to two days following the event (Whitehead et al. 2000). However, in less pristine, more heavily trafficked areas belugas may habituate to vessel noise. For instance, beluga whales appear to be relatively tolerant of intensive fishing vessel traffic in Bristol Bay, Alaska, and beluga whales are commonly seen during summer at the Port of Anchorage, Alaska's busiest port. Like bottlenose dolphins, beluga whales may shift the frequency of their echolocation clicks to avoid masking by anthropogenic noise (Au 1993; Tyack 1999, 2000).

Cook Inlet experiences significant levels of aircraft traffic. The Anchorage International Airport is directly adjacent to lower Knik Arm and has high volumes of commercial and cargo air traffic. Elmendorf Air Force Base has a runway near and airspace directly over Knik Arm. Lake Hood and Spenard Lake in Anchorage are heavily used by recreational seaplanes. Even though sound is attenuated by water surface, Blackwell and Green (2002) found that aircraft noise can be quite loud underwater when jet aircraft are directly overhead. Richardson (1995) discovered that belugas in the Beaufort Sea would dive or swim away when low-flying (<500 m) aircraft passed directly over them. Belugas may be less sensitive to aircraft noise than vessel noise, but individual responses may be highly variable and depend on the beluga's previous experiences, its activity at the time of the noise, and the characteristics of the noise.

5.0 EFFECTS OF THE ACTION ON COOK INLET BELUGA WHALE CRITICAL HABITAT

NMFS has considered the specific aspects of the expansion project that may adversely modify the designated critical habitat of Cook Inlet beluga whales. NMFS has separately considered the annual dredging programs associated with the POA's operations, and concurred with the BA's determination that those actions were not likely to adversely affect CIB critical habitat. With that determination, formal consultation is not necessary for that component of the action, but dredging actions are discussed here as part of associated issues (e.g., pollution). The remaining issues to be considered include the effects of noise on beluga whales, as well as pollution, habitat loss, vessel traffic and ship strikes, and cumulative effects.

Any effect on critical habitat, even if it is solely beneficial, is required to be assessed with respect to effects on quality, quantity, and availability of each PCE and overall for the critical habitat. When the actions within a project are measurable, the influence of those actions will be described through the quality, quantity, or availability. The data are described under the terms of:

- Timing- characteristics of the PCE (i.e. season, years, days)
- Duration- temporary or permanent
- Magnitude- amount of change and whether the characteristic is unique or not unique

After determination of effects, the next step is to assess whether the proposed action is or is not likely to adversely affect the PCE's within the critical habitat. If the effects are expected to be insignificant, discountable, not likely, or are entirely beneficial, they will be described as not likely to adversely affect the PCE and critical habitat. If the effects are expected to be significant and not beneficial, then the action is likely to adversely affect the PCE.

NMFS determined that four out of the five PCEs are not likely to be adversely affected by the port expansion project. PCE # 5 - Absence of in-water noise at levels resulting in the abandonment of habitat by Cook Inlet beluga whales – is the only PCE which has the potential to be adversely affected by this action. Therefore this Biological Opinion is focused on potential effects to PCE #5.

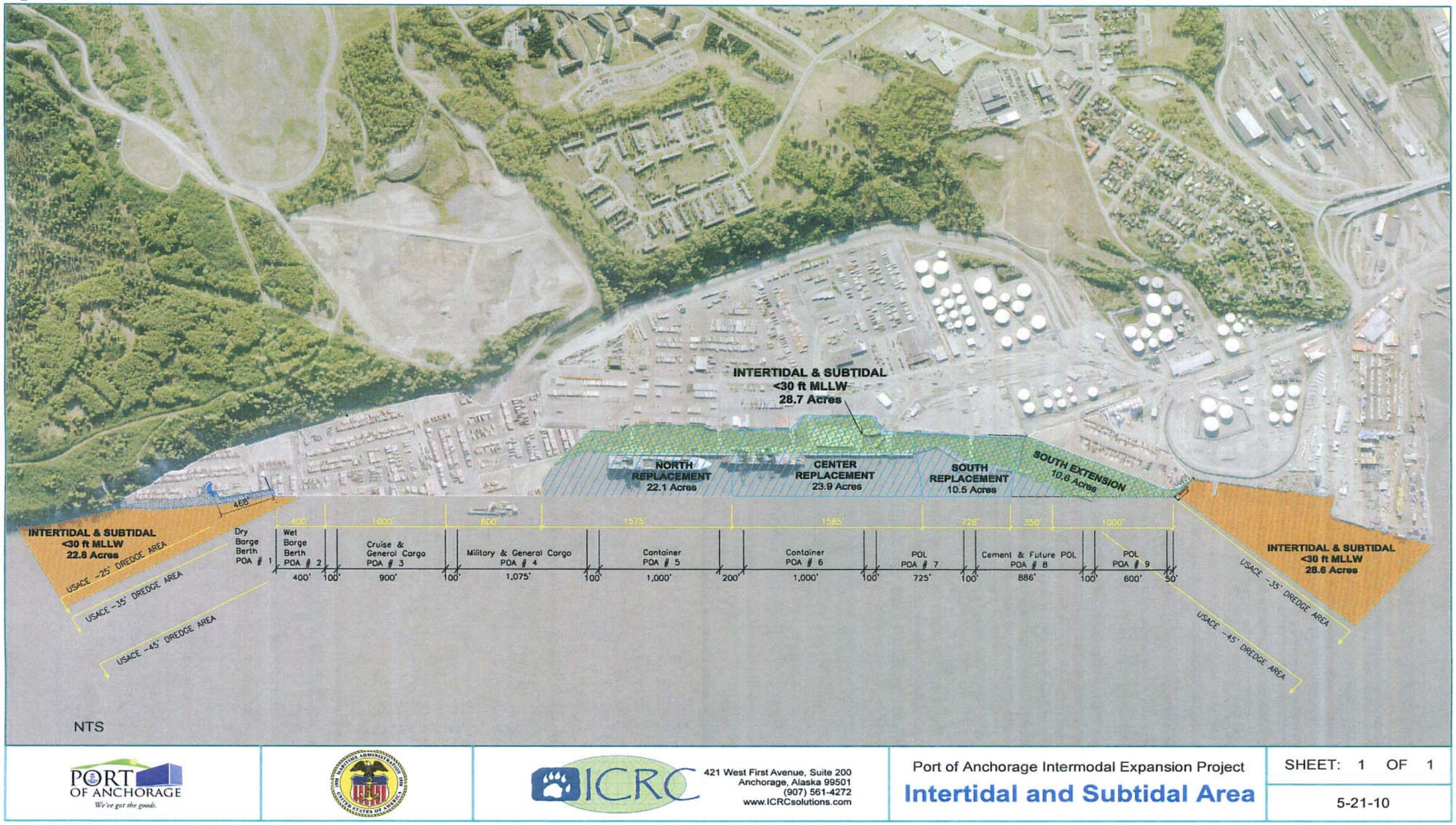
An environmental baseline for each PCE was described in the previous section. Next the effect from the action including mitigation measures (or best management practices (BMPs)) on quality, quantity and availability of each PCE is assessed. If there is a reduction of a PCE, then timing, duration and magnitude are estimated. Construction project activities taking place from 2011 through construction completion and ongoing Port operations thereafter are considered in determining the effect on each PCE and the action as a whole.

DIRECT EFFECTS

5.1 PCE # 1 - Intertidal and subtidal waters of Cook Inlet with depths <30 feet (9.1 m) Mean Lower Low Water (MLLW) and within 5 miles (8.0 km) of high and medium flow accumulation anadromous fish streams

The dredging and fill associated with the MTR Project does affect the existing intertidal and subtidal waters within the Port footprint and is measureable. Figure 6 depicts the MTR fill area, the Corps dredge boundaries and intertidal and subtidal areas to the north and south of the Port of Anchorage Intermodal Expansion Project (PIEP) that could potentially be affected by the action. The action area for this PCE includes intertidal and subtidal lands that are less than - 30 ft MLLW to the north and south of the MTR Project. The total action area is 80.1 acres. The north and south boundaries were selected based upon the conservative possibility that construction could impact sediment deposition outside of the fill footprint.

Figure 6. Arial View of PIEP Boundaries, Areas and Zones. Intertidal and Subtidal North and South (orange color), Area of PCE Reduction (green color), MTR Project Remaining Fill (blue and green lines), Dredge Boundaries and Depths (yellow lines with depths). Source: ICRC, 2010.



The PIEP construction activities from 2010 to completion will result in an increase in the total footprint of the Port through an expansion outward into Knik Arm. Since the ground disturbing activities in 1958, the dredging and construction in the Port harbor has been ongoing for the past 50 years. Over the last five decades, the quality of this PCE was changed due to ongoing operations and has not reestablished the original biodiversity of marine vegetation or fish. The quality of the acreage to be reduced by the MTR Project is discountable due to past ground and area disturbances from Port construction, dredging operations, ship traffic, military and Coast Guard use, and the growth of the City of Anchorage and Elmendorf Air Force Base (EAFB). As stated in Section 4.2 of the BA, vessel traffic is not anticipated to increase, noise levels will remain unchanged during construction, pile driving will cease when construction is complete, and the expanded Port operations will be more efficient than they are currently (ICRC, 2009). As a result, the quality of the intertidal and subtidal water will not be appreciably affected. The PIEP and associated Corps dredging and disposal may affect quality, but is not likely to adversely affect the quality of PCE # 1.

5.1.1.1 ***Quantity of Habitat***

The PIEP phasing plan has been updated to show four remaining phases for fill and bulkhead construction. The possible sequence of construction has been modified; however, the overall expansion footprint and means and methods have not changed. The MTR Project construction activities will fill the footprint areas of the South Extension (10.6 acres), South Replacement (10.5 acres), Center Replacement (23.9 acres) and North Replacement (22.1 acres) and therefore remove 67.1 acres of water. Because of historical and ongoing dredging in front of the docks to -35 ft MLLW, only 28.7 acres of the 67.1 acres of future fill area are shallower than -30 ft MLLW and located behind and under the current dock structure. Figure 4 shows this area of PCE # 1 reduction highlighted in green. Currently, this acreage is not utilized by the Cook Inlet beluga whale.

Out of the total 80.1 total acres of intertidal and subtidal waters in the action area, 51.4 acres remain unaffected by the action because it will not be filled (and therefore removed) or it is already greater than - 30 ft MLLW. The MTR Project would remove less than 36% of PCE #1 in the action area (28.7 acres divided by 80.1 acres times 100). The 28.7 acres removed is minimal when compared to the entire intertidal and subtidal acreages that exist within Areas One and Two critical habitat, which are less than -30 ft MLLW.

The timing or schedule for the filling of the PCE reduction is anticipated to occur over the next ten years, with phases completed based upon available funding, technical considerations, and tenant requirements. The duration is permanent since the sheet pile bulkhead and fill material are to remain in place for on-going operations at the Port. Overall, the magnitude of the change will be removal 28.7 acres of this PCE. The PIEP will affect quantity, but is not likely to adversely affect the quantity of PCE # 1.

5.1.1.2 ***Availability of Habitat***

The Knik Arm and the Cook Inlet has habitat as defined in PCE #1 in abundance. The Port footprint includes a small amount of valuable intertidal and subtidal habitat that will be removed by the Port expansion. The type of dock structure under construction and the associated dredging and future operations will not obstruct access to this PCE anywhere else in Type One or Two critical habitat. Historical and current shipping lanes to the Port are not being modified and therefore will not obstruct the availability of PCE # 1. Potential reductions to the availability of intertidal and subtidal habitat are insignificant and not unique. The PIEP and associated Corps dredging and disposal are not likely to affect the availability of PCE # 1.

5.1.1.3 ***Conclusion***

The completion of the Port expansion and deepening of shipping lanes will result in the direct loss and modification of beluga whale habitat. The MTR Project will result in an increase in the total footprint of the Port through an expansion outward into Knik Arm and north and south along the shoreline. Between 2010 and 2013, the Project activities will fill 67.4 acres of intertidal and subtidal habitat from creation of the new docks. The total loss from all Project activities will be 135 acres (67.6 acres were filled between 2006 and 2008). The permanent loss of habitat will be mitigated as agreed by the POA and stipulated in the Corps 404/10 permit. Based on the best available data and previous fish and invertebrate sampling efforts, the construction area has a low diversity and abundance of marine vegetation, invertebrates, and fish. NMFS considered the habitat value on the area to be filled during the analytical process pursuant to the National Environmental Policy Act and associated with the expansion project. While the area in general was recognized as important habitat (i.e., type 1 habitat), the nearshore areas to be filled were not believed to have corresponding loss in habitat function. This was due, in part, to the fact that beluga whales are known to use structure in their feeding strategy. Research on belugas in Bristol Bay suggested these whales' preferred feeding habitats are relatively shallow channels where fish were confined or concentrated by bottom structure (Frost et al. 1983, Fried et al. 1979). NMFS has observed beluga whales utilizing rip-rap bulkheads at the Port of Anchorage to corral salmon in a cooperative feeding effort. Many commercial set netters have observed whales feeding at the end of their shore based gill nets, apparently taking advantage of this effect.

The loss of 135 acres of intertidal and subtidal habitat is not expected to result in reduced availability of prey for beluga whales. Fish studies were conducted in 2004 and 2005 to enumerate and identify fish species' and how they use the habitat around the Port. These studies concluded fish species abundance and diversity is highly variable throughout the year, but overall juvenile salmon were the most prevalent around the Port. The habitat to be filled is used as migrating, rearing, and foraging habitat for fish. However, habitats with the same attributes as the area to be filled exist in many other areas of Knik Arm.

For example, the extreme turbidity and poor visibility in Knik Arm waters is likely to severely limit the success of visual feeding by fish, but visual feeding may be possible in microhabitats within the surface waters where short periods (minutes) of relative quiescence in the generally turbulent water allow partial clearing. From observations, it appears these areas can occur along shorelines and in the middle of the Knik Arm. Fish collected in offshore surface waters of upper Cook Inlet south of Fire Island suggest juvenile salmon were not favoring shorelines, as many of these fish had very full stomachs.

Beluga whales continuing to use the habitat will be traversing and feeding in a deeper channel, and will be exposed to construction and operational noise. Beluga whales have continued to use the area within the original footprint of the Port in which past port operations and ongoing maintenance dredging occurred. This flexibility in dealing with a changing physical habitat may be the result of adaptation to the Cook Inlet environment, which is highly dynamic due to huge tides, silty substrate, and seasonal ice movements. To date, NMFS-approved observers have reported that beluga whales continue to use areas within the MTR project footprint and are not behaviorally reacting to exposure to pile driving noise. Additionally, habitat use has remained unchanged. Pre-MTR construction, marine mammal surveys along Knik Arm and pre in-water pile driving surveys report that traveling followed by opportunistic feeding were the primary beluga whale behaviors around the POA. Reports required under the 2008 IHA show the same trend in whale behavior. In addition, NMFS researchers observed beluga whales feeding off the newly filled North Backlands area further indicating that POA/MARAD expansion construction is not eliminating foraging opportunities. Based on these data and the fact MMOs are not observing acute behavioral reactions to pile driving, NMFS anticipates that beluga whales would not alter their behavior in a way that prevents them from entering and/or transiting throughout Knik Arm. While the action area provides some value as feeding habitat for beluga whales, it is less important than several other recognized high-use foraging areas such as the Susitna River delta, the mouth of the Little Susitna River, the Chikaloon River estuary, and upper Knik Arm. Should any reduction in use of the action area occur, NMFS believes the implications for recovery would be far less than that within these important feeding habitats.

The MTR Project is not expected to significantly affect the quality of the intertidal and subtidal waters beyond their current state. Only 28.7 acres of low quality intertidal and subtidal water less than -30 ft MLLW will be permanently lost from the action and the availability or access to this PCE #1 in critical habitat Areas One and Two will not be reduced. NMFS agrees that the PIEP construction activities, Corps dredging and disposal, and continuous Port operations may affect, but are not likely to adversely affect PCE # 1 of the Cook Inlet beluga whale critical habitat.

5.2 PCE # 2 Primary prey species consisting of four (4) species of Pacific salmon (Chinook, sockeye, chum, and coho), Pacific eulachon, Pacific cod, walleye pollock, saffron cod, and yellowfin sole;

The Port is between five and twenty miles from the summer feeding locations of the Little Susitna, Susitna, Eagle and Beluga Rivers. The anadromous fish streams within 5 miles are Ship Creek and Chester Creek, which are 0.97 miles and 2.57 miles to the south, respectively. Six Mile Creek is located 4.36 miles to the north. The Alaska Department of Fish and Game report that these three streams yield Chum, Coho, Chinook, Sockeye, and Pink salmon as well as Dolly Varden. In determining the action area for this PCE, the loss of shoreline and noise affect to fish were considered. Permanent loss of shoreline of up to 400 feet westward from the existing dock will result from the fill activities. Construction pile driving noise will radiate throughout the water from the noise source until it dissipates to background levels. However, no standard distances from a noise source have been established for prey fish protection. Therefore, the action area (remaining to be filled) is 400 ft from the existing dock along the length of the MTR Project (approximately 5,236 ft).

5.2.1.1 ***Quality of Primary Prey Species***

Several fish studies have been conducted in the Knik Arm for the Knik Arm Bridge and Toll Authority (KABATA) and the PIEP over the last twenty years. A benthos study conducted by Pentec Environmental in 2004-2005 built upon earlier studies and collected fish in offshore surface waters to examine the temporal and spatial patterns of fish distribution in the Knik Arm (Pentec, 2005). The extent of this research was from the upper Cook Inlet to the south of Fire Island.

In 2004 and 2005, the Pentec study reported 17 different species of fish caught by beach seine sampling at two locations near the Port; one north of the Port around Cairn Point and one south at Ship Creek. The ten top fish species are ranked by quantity and provided in Table 6-1. Fifty percent of the catch consisted of the Threespine Stickleback, comprising approximately 31 percent of the total catch, and juvenile Coho Salmon, comprising approximately 19 percent of the total.

Top Ten Species of Fish Catch in 2004 and 2005 Beach Seine Sampling (Pentec, 2005)

Species	Catch	Percent	Rank
Threespine Stickleback	446	30.7	1
Juvenile Coho Salmon	268	18.5	2
Longfin Smely	154	10.6	3
Saffron Cod	136	9.4	4
Junevile Chinook Salmon	121	8.3	5
Ninespine Stickleback	106	7.3	6
Juvenile Sockeye Salmon	60	4.1	7
Juvenile Chum Salmon	48	3.3	8
Eulachon	31	2.1	9
Adult Coho Salmon	20	1.4	10

The best available data indicate that shoreline construction activities of the MTR Project and continued Port operations have not affected the diversity of the species that utilize the area around the Port. The conditions in which the prey survive will continue to exist. The effect is insignificant and discountable and therefore not likely to affect the quality of the PCE #2.

5.2.1.2 ***Quantity of Primary Prey Species***

Baseline studies were conducted to enumerate and identify prey fish species and how they use the habitat around the Port (Pentec, 2005). These studies concluded fish species abundance and diversity is highly variable throughout the year, with overall juvenile salmon being the most prevalent around the Port. Habitats with the same attributes as the Port exist in many other areas of Knik Arm and Cook Inlet.

The Knik Arm has extreme tides and tidally-generated currents, and high suspended sediment loads ranging into the hundreds of nephelometric turbidity units (NTU) (Pentec, 2005). The extreme turbidity and resulting poor visibility limits the ability of fish to visually feed. However, Pentec concluded that, based upon their earlier work and other studies, that visual feeding by juvenile salmonids was possible in microhabitats within the surface water where short periods of quiescence allowed partial clearing. These small lenses of clearer water could occur along the shorelines as well as in the middle of the Arm. The data collected from south of Fire Island suggested that juvenile salmonids were not favoring shorelines. Therefore, the shoreline intertidal and subtidal areas were not necessarily essential to the survival of the juvenile salmonids.

As required by the Corps 404/10 permit, the POA conducted a live caged fish study in 2008 and 2009 (URS, 2009). During this study, juvenile coho salmon were exposed to sheet pile driving noise (vibratory and impact pile driving) while acoustic measurements were made and extended behavioral observations of exposed fish were followed by necropsies to look for effects. The juvenile salmonids were exposed to pile driving at distances ranging from 0.6 meters to 50 meters from the pile driving hammers. Three reference cage exposures were conducted at Chester Creek, approximately 4 km south of the pile driving location. Test conditions, pile driving type, exposure dates and acoustic level for the 16 tests conducted are included in the Biological Assessment presented to NMFS. The accumulated sound exposure level (SEL), maximum SEL, and maximum peak sound pressure measurements are provided for the impact and vibratory pile driving.

Despite attempts to expose fish to the maximum potential noise at very close range, no acute or delayed mortality of any juvenile coho was observed as a result of the exposure to in-water pile driving (URS, 2009).

Behavior in all 16 tests, including the three reference tests were recorded as normal. Slight hemorrhaging was observed in five necropsied fish, including two reference fish. However, this was attributed to handling from the hatchery, field transfers, or from the period from euthanasia to necropsy (URS, 2009). The recent fish study demonstrated that pile driving construction during the MTR Project at the Port does not kill fish and the potential for noise effects on fish is low. Since pile driving noise is the primary concern for fish impact, it is reasonable to conclude that construction and ongoing Port operations does not kill fish and does not reduce the numbers of fish. The PIEP, associated Corps dredging and disposal, and future Port operations may affect, but are not likely to adversely affect, the quantity of PCE # 2.

5.2.1.3 ***Availability of Primary Prey Species***

NMFS data indicates that the Cook Inlet beluga whale utilizes the Susitna delta area and Chikaloon Bay for foraging and moves through the Knik Arm between the two (NMFS BiOp, 2009). The MTR Project construction activities do not affect these primary foraging locations. The Port area is not a primary feeding location for the whale. Monitoring by marine mammal observers indicates that beluga whales primarily appear to swim or travel past the Port to the north, feeding opportunistically, and then return traveling to the south.

Among behaviors recorded by marine mammal monitors of all beluga whale sightings (groups of one or more) observed during the 2008 construction season were feeding and suspected feeding. Out of 59 sightings of beluga whales from 8 July 2008 through 30 November 2008, 22 percent (13 sightings) were recorded as feeding. These sightings were within the MTR Project footprint, outside of the footprint, and outside of the vibratory pile driving harassment radii of 800 m. Within the same period, 432 individual beluga whales were recorded and 73 belugas were observed feeding or suspected feeding inside the 800-m vibratory pile driving harassment radii. This represents approximately 17 percent of the total observed individuals (ICRC Database, 2008-2009).

Recorded behaviors of all beluga whale sightings (groups of one or more) observed during the 2009 construction season include feeding and suspected feeding. Out of 170 beluga whale sightings from 28 March 2009 through 14 December 2009, 41 percent were recorded as feeding or suspected feeding. These sightings were within and outside the MTR Project harassment radii for pile driving. Within the same period, 1,221 individual beluga whales, were recorded and 31 individuals were observed feeding or suspected feeding inside the harassment radii (within 800 m through July 14 2009 and within 1,300 m to the end of the year). This represents approximately 2.5 percent of the total observed individuals (ICRC Database 2008-2009).

Because the total number of beluga whales observed each year in 2008 and 2009 exceeds the NMFS' population estimate, it is assumed that individuals were counted multiple times throughout the construction seasons. This data shows that the beluga whale continues to utilize the area around the Port and upper Cook Inlet. Observations along the opposite shoreline near Port MacKenzie include similar activities such as milling, foraging, and feeding. The Port area is primarily used for transit and the action will not measurably reduce the availability of the primary prey species. The aquatic environment around the Port is not unique and Areas One and Two of critical habitat have additional locations more suited for feeding on primary prey species.

Because the PIEP does not restrict passage of the whale to and from the primary feeding locations elsewhere in the Knik Arm, the action may affect, but is not likely to adversely affect, the availability of PCE # 2.

5.2.1.4 ***Effects to prey species from disposal***

The bottom composition at the disposal site is dynamic. While material deposited by dump scows such as boulders and large chunks of densely compacted bottom sediment may remain in place, much of the other material is likely widely dispersed by currents as it sinks or is carried away over time by scouring after reaching the bottom. The likelihood of direct mortality to primary prey species from disposal is probably low, even for bottom-feeding fish such as yellowfin sole, which is theorized to be more susceptible to harm than other primary prey species. Indirect mortalities for all primary prey species are less likely than direct mortalities given that dredge disposal occurs over an area that is continually changing and the disposal simply introduces more material into the system.

5.2.1.5 ***Conclusion***

Several of the primary prey species exist in the Port area. Approximately 5,000 ft of shoreline will be filled to construct the expanded dock bulkhead. However, research has demonstrated ability for fish to survive away from the shoreline and that the pile driving activities do not adversely affect fish survival. The action area for this PCE is not a primary feeding location for the beluga whale and does not inhibit the ability of the beluga to transit to their primary feeding areas. The implementation of BMPs (including a restoration and conservation program, no fill or pile-driving activities within one week of smolt releases, and implementing a fish rescue and release plan) to mitigate impacts on fish during construction and post-construction provides fish refuge, and enhances the survivability of fish in the area; thereby minimizing impacts on prey availability for beluga whales. Because of the ongoing BMPs in place and the permanent watershed improvements planned, the effect to quality, quantity, and availability of resources and habitat for primary prey species is insignificant. The PIEP construction activities, associated Corps dredging and disposal, and continuous Port operations may affect, but are not likely to adversely affect, PCE # 2 of the Cook Inlet beluga whale critical habitat.

While any of these species may be found either in the water column or near the bottom in the areas that will be dredged, the likelihood of impact is very low. During dredging, these prey species could possibly be struck by a clamshell dredge bucket or sucked in by a hopper dredge, but given the repetitive nature of dredging operations, the short duration, and the likelihood of the noise produced in the immediate area with these activities dispersing them, it seems unlikely that prey species would be directly impacted. If there were any prey species mortality, it would be negligible relative to the total available prey in the action area. Similarly, the likelihood of indirect effects to prey species appears low. When all dredging is complete, the area of bottom habitat will remain similar to the existing condition. The main difference is that it will be deeper; although still well within usable depths for all primary prey species and within the feeding depths of the beluga whale.

5.3 PCE # 3 - The absence of toxins or other agents of a type or amount harmful to beluga whales.

Cook Inlet belugas appear to have a lower body-load of chemical contaminants than other populations. However, the impact of contaminants on the belugas' health is unknown (NMFS 2008). The Conservation Plan (NMFS, 2008) and the Final Rule for critical habitat designation state that contaminants are a concern for the sustained health of Cook Inlet beluga whales.

Toxins and other agents, PIEP details, and the Master Storm Water Pollution Prevention Plan (SWPPP) are described in detail in Section 4.0 of the BA (BA, 2009). The existing drainage system at the Port includes six documented below ground drain systems and one open ditch system within the Port drainage basin; all discharging to Knik Arm (POA SWMP SWPPP, 2009). The Port is under a Municipal Separate Storm Sewer System (MS4) permit (No. AKS052426) for discharges of storm water into the Knik Arm. Behind the Port facility, the Gaylord Gulch drainage ditch system conveys storm water runoff from EAFB through the Port to Knik Arm. The two systems are currently co-mingled and fall under the POA's MS4.

The PIEP and the expanded Port operations will not add new types of services over what has been delivered for the last 50 years; only make those currently provided safer and more efficient. Improvements and expansion of the current storm drain systems and oil/grit/water separators (OWSs) is planned as part of the PIEP (ICRC, 2009).

At this time, the level of toxins that would harm Cook Inlet beluga whales or destroy or adversely modify critical habitat is unknown. ICRC (2009) describes the potential water pollutant sources in the Port area. Upper Cook Inlet has been identified as a Category 3 Water-body, or water for which there is insufficient or no data to determine if any designated use is impaired. As such, there are no identified water quality concerns or total maximum daily loads for Cook Inlet (POA SWMP SWPPP, 2009). The biological assessment also discusses the direct and indirect effects of the MTR Project on water quality (ICRC, 2009).

5.3.1.1 *Hazardous Materials and Oil Spills*

The Port does not stock toxic pollutants. Additionally, the Port does not use chemical means to clear snow in the winter and has no plans to do so in the future. The PIEP design includes permanent low impact development such as infiltration ditches, retention of existing vegetation, establishment of grassed areas, and biofiltration swales.

As described in the BA, management of hazardous materials and waste at the Port is conducted by the POA, Port tenants and users, including operators of lease facilities (ICRC 2009, 2010). The POA confirms that those users comply with applicable permits and regulations via lease agreements and active oversight including:

- the POA performs required, routine maintenance inspections of the petroleum facilities.
- The US Coast Guard performs periodic and unannounced drills at the petroleum facilities.
- All users of the petroleum facilities are required to retain on-site monitors for the duration of every ship fuel transfer, whether coming into or leaving the Port.
- Clarify that each tenant has their own hazardous materials management plan and must comply with their own company guidelines and requirements.
- The POA does not actively audit all user operations; the Port users are responsible for that.
- The POA actively oversees all dock operations when hazardous materials are involved (e.g. when containers are being offloaded). This includes periodic container inspections.
- The POA safety officer is on scene for any spill that is reported by users and also for any reported by POA personnel.

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5.3.1.2 ***Vessels***

The MTR Project expansion will benefit water quality due to the reduced potential for mishaps caused by crowding at the existing berths. Currently cement and petroleum, oil, and lubricant (POL) tankers must utilize the same berth for offload of their cargo. One vessel is often waiting off the dock for berth space to clear for docking. This requires careful piloting through tides, wind, ice, and currents. PIEP completion reduces potential risks by reducing safety hazards associated with ships in queue and limited buffer space between vessels.

Discharges, by law, are not allowed within three miles of land. These include oily waste, sewer water, gray water (e.g., shower water), and garbage. Gray water and sewer water, provided they are free from oil waste, may be discharged in the open sea. Larger vessels utilizing the Port would reduce the risks associated with oil spills due to larger space to maneuver and slower movements when changing direction.

The PIEP , the MTR Project, and associated Corps dredging and disposal are not expected to introduce additional sources of pollutants to the waters of Knik Arm. The objective of the MTR Project is to relieve overcrowding at the existing dock. The result is a safer and more efficient operation. The empirical data collected to-date show that the beluga whale has not abandoned the Port harbor area, despite ongoing Port operations for the last five decades and construction of the PIEP since 2005. The PIEP may affect, but is not likely to adversely affect, the quality of PCE # 3.

5.3.1.3 ***Quantity of Water Resource***

The PIEP does not remove water from the Port harbor. PIEP improvements contribute precipitation runoff of similar or greater quantity from expanded and improved paved surfaces. The PIEP may affect, but is not likely to adversely affect, the quantity of PCE # 3.

5.3.1.4 ***Availability of Water Resource***

The Cook Inlet beluga whale migrates through and among critical habit areas. The beluga whale is and will be capable of moving within Area One and Area Two for any of the PCEs they require, as the PIEP does not preclude or restrict access by belugas. The PIEP may affect availability, but it is immeasurable so the affects are insignificant and discountable. The PIEP is not likely to affect the availability of PCE # 3.

5.3.1.5 ***Conclusion***

Controls are currently in place to prohibit introduction of toxins into Knik Arm due to construction activities and ongoing Port operations. See Table 6-4 of ICRC 2010 for a description of pollution prevention systems at the POA. In addition, the project design includes additional storm drain systems and oil/grit/water separators (OWSs) to treat port drainage. As each phase of the expansion is completed, additional improvements to the storm water drainage will be placed into utility. The result will be a significantly improved system. Risk of releases to the water will be reduced due to expanded berthing facilities, newer systems and more efficient operations.

Given the mitigation measures in place at the Port for operations and PIEP construction activities, and the resulting improved facilities for the same operations that have taken place for the last five decades, the direct or indirect effects on the Cook Inlet beluga whale in Knik Arm from discharges of all pollutants are considered *insignificant and discountable*.

Annual maintenance dredging and disposal activities at the Port generally begin in mid-May, shortly after the ice is out of the inlet, and continue into November. Sediments dredged by current annual maintenance operations and the sediment that will be dredged from the proposed dredging footprint have been evaluated to determine the presence of contaminants (Corps, 2008). Analysis included volatile and semi-volatile organic compounds, total recoverable petroleum hydrocarbons, PCBs, pesticides, cadmium, mercury, selenium, silver, arsenic, barium, chromium, and lead. Contaminant concentrations in the samples were below screening levels (State of Washington, Department of Ecology, and Sediment Management Standards Minimum Clean-up Levels - Chemical Criteria) and have been determined to be suitable for in-water discharge. Although the sediment does not contain significant contaminant concentrations, dredging and disposal activities create localized increases in suspended sediment concentrations and turbidity and slightly lower dissolved oxygen concentrations at the dredging and disposal sites (ICRC, 2009).

Dredged material is transported to the disposal site by tug and barge and discharged in increments of approximately 1,500 cubic yards (cy). Mixing zones are not necessary due to the naturally high suspended sediment load in the receiving waters and the similarity of the dredged material with the material comprising the natural sediment load. Tides and currents affect the extent and magnitude of the water quality impacts but observable impacts in the upper water column are generally limited to an area within several hundred ft downstream of the dredging or disposal activity.

The risk of accidental spills during dredging and disposal would temporarily increase as a result of increased vessel traffic when maintenance and transition dredging is taking place at the same time. The increased risk would be small and would be minimized through enforcement of standard port operational controls (see Table 6-4 of ICRC 2010) that maintain safe operational and navigation conditions. Compliance with established contingency plans would limit impacts in the event of an unplanned release.

Sediment testing has not revealed the presence of contaminants in dredged material. Maintenance dredging is only removing material that has been recently deposited. The effect of dredging and disposal on water quality will only result in temporary and localized increases in turbidity and suspended sediment levels and temporary and localized decreases in dissolved oxygen levels in a region that is naturally high in suspended sediment and high in dissolved oxygen.

Transitional and deepening dredging removes highly compacted sediment and the presence of buried contaminants in this material is unlikely. If buried materials such as drums were discovered, they would be removed and properly disposed of on shore and any resultant release of contaminants would be mitigated according to established spill plans.

The PIEP construction activities, Corps dredging and disposal, and continuous Port operations may affect, but are not likely to adversely affect PCE # 3 of the Cook Inlet beluga whale critical habitat.

5.4 PCE # 4 - Unrestricted passage within or between the critical habitat areas.

Although many populations of beluga whales are migratory, the Cook Inlet stock has been shown to remain in Cook Inlet year round (Hobbs et al., 2005), with seasonal distribution patterns closely tied to prey availability. Annual aerial surveys and satellite tagging data from NMFS have established the distribution and abundance of beluga whales in Cook Inlet. During the spring and summer (May – July), Cook Inlet beluga whales are found in the upper Inlet, primarily concentrated in the Susitna River delta area and to a lesser extent in Knik Arm, Turnagain Arm, and Chickaloon Bay, coinciding with strong runs of eulachon and salmon. In the fall (August – October), belugas follow fish runs in Knik Arm and Turnagain Arm. As the fish runs decline in the fall, the beluga whales then disperse offshore throughout the mid Inlet and remain there during the winter (December to March) (Hobbs et al., 2005).

Cook Inlet beluga whales ascend to upper Knik Arm on the flooding tide, feed on salmon, then fall back with the outgoing tide to hold in waters north of the Port. Whales moving up Knik Arm tend to prefer the eastern shoreline, in the immediate vicinity of the Port, while whales moving out of Knik Arm tend to hug the western shoreline (Cornick and Saxon-Kendall, 2009).
The discussion throughout this section is based on the analysis of the effects of the action on habitat use by the Cook Inlet beluga whale for movement within critical habitat Area One, where the Port is located. The MTR Project is expanding the existing Port located on the eastern side of Knik Arm along the shoreline. This MTR Project does not include constructing (either temporarily or permanently) structures within the harbor to restrict passage. The action results in permanent loss of harbor width (up to 400 ft along the north-south shoreline) and temporary, intermittent noise from pile driving will be generated during construction activities.

5.4.1.1 *Quality of Unrestricted Passage*

To ensure that the MTR Project construction activities do not cause passage restriction, behavior monitoring and sighting documentation have continually been implemented since pre-construction through current construction activities. Building on lessons learned and in response to new permit requirements, the monitoring programs and processes have been continuously modified and improved each year. Therefore, the data collected is generally comparable, but not exactly the same. General trends (or lack of trends) may still be gleaned from a review of all previous years. Post-construction monitoring for marine mammals is planned and may eventually provide information on long-term effects. Marine mammal monitoring performed in 2005 and 2006 prior to PIEP in-water operations (scientific marine mammal monitoring) was conducted to obtain a standard baseline of Cook Inlet beluga whale activities. Construction marine mammal monitoring began in 2008 with the start of in-water construction activities.

5.4.1.2 *Port Footprint and Harassment Zones*

LGL Alaska Research Associates, Inc (LGL) reports summarize scientific marine mammal monitoring observations conducted from the Cairn Point bluff station in 2005 and 2006 (Prevel Ramos et al. 2006; Markowitz and McGuire 2007). No in-water construction was conducted in 2005 and only in-water fill construction (no pile driving) was conducted in 2006 nor in 2007. At the time, the MTR Project footprint was defined as the planned fill area of the expanded Port. A general conclusion may be made that the observations of the beluga whale inside and outside the MTR Project footprint differed significantly depending on the time of year. Whales were observed visually more often along the eastern or western shoreline of the Knik Arm rather than in the center of the water body.

In-water construction continued in 2007 and included placement of fill material at the north end. No pile driving was conducted in 2006 or 2007. Pile driving began in August 2008. The data collected in 2007 and 2008 by the scientific marine mammal observers located at the Cairn Point bluff station again show a variation of whale sightings (inside and outside the MTR Project footprint), but still suggests that the whales are often observed along the shorelines; both east and west.

It is important to note that the focus of the marine mammal observers is on the harassment zone and the construction activities being conducted at that time. All observers were located on the East side of Knik Arm in or near the Port. The distribution shown on the figures tends to depict the highest numbers of sightings within the Port vicinity. This may be due to the locations of the observers and the focus on sightings prior to the beluga whale reaching the harassment zone or Port footprint.

The data shows a high level of beluga activity within the Port area continuing through the 2008 and 2009 construction years, even though in-water pile driving and the resulting noise was ongoing during those years. The spatial distribution research over the past five years shows that the Port has not been abandoned by the Cook Inlet beluga whale. Because future PIEP actions are very similar to those that have already taken place over the previous years, it is reasonable to conclude that the quality of the unrestricted access will not be significantly affected by the future construction. Once construction is complete, ongoing operations will no longer have an in-water pile driving noise source. The marine mammal monitoring will continue for two years past construction completion to identify any changes in behavior. The PIEP and associated Corps dredging and disposal may affect quality, but are not likely to adversely affect the quality of PCE # 4.

5.4.1.3 ***Quantity of Unrestricted Passage***

The quantity of unrestricted passage will be permanently reduced by the action due to fill requirements for the remaining phases. Up to 48 acres of area (up to 400 ft wide) will be removed. The maximum distance that the PIEP will fill is up to 400 ft west of the current dock line (less in some locations) for approximately 5,236 ft. This results in a maximum loss of up to 48 acres of area from the dock face. Acreage behind the dock face may be considered already restricted at this point and is of minimal use for transit through the critical habitat areas. The acreage to be filled is currently at or near the dock face and other ongoing Port operations, where the beluga whale already navigates around structures and vessels. The action may affect quantity, but is not likely to adversely affect the quantity of PCE # 4.

5.4.1.4 ***Availability of Unrestricted Passage***

The availability of unrestricted passage will be reduced by the action, because fill will be placed up to 400 ft westward from the current dock face. The width of the harbor from the Port on the eastern side to the western side of the Knik Arm is approximately 12,000 ft. Filling 400 ft out of a 12,000-foot passageway will result in a maximum loss of approximately 3 percent of the total.

5.4.1.5 ***Conclusion***

Beluga whales have been observed near the Port before the in-water construction activities. The scientific and construction monitoring data collected do not demonstrate discernable behavior changes or avoidance of the location despite the presence of dredging, construction, and other maritime activities. Other reports and studies provide a similar conclusion (Prevel Ramos et al. 2006; Markowitz and McGuire 2007; Cornick and Kendall 2008). Observation reports indicate that beluga whales are primarily transiting through the Port area while opportunistically foraging, and MTR Project construction, dredging, and other activities are not blocking this transit. The Cook Inlet beluga whale has been observed for 5 years at and around the Port. In the construction season of 2009, 1,221 beluga whales were observed. The combined data show an increase of monthly sightings of individual belugas and no changes in their behaviors have been observed to reflect that Port expansion or operation is affecting the movements or abundance.

The action does affect the quantity and availability of the PCE due to planned fill requirements that will remove up to 400 ft of useable transit width within the harbor. This quantity is relatively small (3 percent) compared to existing passage area. There has been no observed reduction in beluga whale presence or ability to transit to or from the other areas of the critical habitat during construction. Post-construction expanded Port operations will be quieter than current operations and construction pile driving will be absent. Therefore, the PIEP construction activities and continuous Port operations may affect, but are not likely to adversely affect PCE # 4 of the Cook Inlet beluga whale critical habitat.

Corps dredging and disposal will not lead to a physical barrier that could impede beluga whales. Examples of physical barriers include dams and causeways. While underwater noise is covered in the next section relative to habitat abandonment, unrestricted passage could be affected by underwater noise from dredging if it created a “behavioral barrier” that causes beluga whales to pass through an area with difficulty. Dredging occurs nearly continuously from May through October each summer and has occurred every summer for decades. Despite this, beluga whales routinely approach within 50 meters of dredges and thus trigger temporary shutdowns until they have moved to a safe distance.

Long term monitoring data for beluga whale responses to dredging does not exist. Belugas generally tend to enter Knik Arm on an incoming tide and exit Knik Arm along the shore on an outgoing tide. Beluga movements appear to be dependent on the tide status and foraging preferences. Passage of beluga whales through the area does not appear to be restricted by dredging. It is possible that belugas might behave differently if dredging did not occur, but the repeated observations of beluga whales passing near dredges indicate that if there is a behavioral change that has taken place in response to dredging it is not detectable and is not a barrier to their movement in and between areas of critical habitat.

The effects on the Cook Inlet beluga whale critical habitat from dredging and disposal are expected to be *insignificant* and *discountable*. Corps dredging and disposal may affect, but are not likely to adversely affect, PCE #4 of Cook Inlet beluga whale critical habitat.

5.5 PCE # 5 - Absence of in-water noise at levels resulting in the abandonment of habitat by Cook Inlet beluga whales.

Construction and operation of the expanded Port of Anchorage will introduce significant sound (noise) into the waters of Knik Arm. We consider this noise to be the primary issue associated with the project's effects on Cook Inlet beluga whales. Beluga whales use sound rather than sight for many important functions. They are often found in turbid waters in northern latitudes where darkness extends over many months. Beluga whales use sound to communicate, locate prey, and navigate, and may make different sounds in response to different stimuli. Beluga whales produce high frequency sounds that they use as a type of sonar for finding and pursuing prey, and likely for navigating through ice-laden waters.

In Cook Inlet, beluga whales must compete acoustically with natural and anthropogenic sounds. Human-induced noises within the action area include large and small vessels, aircraft, pile driving, shore based activities, dredging, filling, and other events. The effects of human-induced noise on beluga whales and associated increased background noises may be similar to our reduced visibilities when confronted with heavy fog or darkness. These effects depend on several factors including the intensity, frequency, and duration of the noise, the location and behavior of the whale, and the nature of the acoustic environment. High frequency noise diminishes more rapidly than low frequency noises. Sound also dissipates more rapidly in shallow waters and over soft bottoms (sand and mud). Much of upper Cook Inlet is characterized by its shallow depth, sand/mud bottoms, and high background noise from currents and glacial silt (Blackwell and Greene 2002), thereby making it a poor acoustic environment. A 2001 acoustic research program within upper Cook Inlet identified underwater noise levels (broadband) as high as 149 dB re: 1 µPa[1] (Blackwell and Greene 2002). That noise was associated with a tug boat that was docking a barge. Observations of beluga whales off the Port suggest these whales are not normally harassed by such noise, although the whales may tolerate noise that would otherwise disturb them in order to feed or to conduct other biologically significant behaviors. Ship and tug noise have been present at the Port for several decades and will continue during and after construction is completed.

Since 1997, NMFS has been using generic sound exposure thresholds to determine when an activity in the ocean produces sound potentially resulting in impacts to a marine mammal and causing take by harassment (70 FR 1871). NMFS is developing new science-based thresholds to improve and replace the current generic exposure level thresholds, but the criteria have not been finalized (Southall et al. 2007). The current Level A (injury) threshold for impulse noise (e.g., impact pile driving) is 180 dB root mean square (RMS) for cetaceans (whales, dolphins, and porpoises) and 190 dB RMS for pinnipeds (seals, sea lions). The current Level B (disturbance) threshold for impulse noise is 160 dB RMS for cetaceans and pinnipeds. The current Level B threshold for non-pulsed noise (e.g., vibratory pile driving) is 120 dB RMS[2].

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[1] All subsequent decibel figures in this opinion are referenced to the accepted in-water standard of 1 micro pascal (1 µPa).

[2] Because background noise is elevated within lower Knik Arm to levels reaching 120 dB, that threshold would be unmeasurable. Therefore NMFS has set thresholds for Level B take authorizations in Cook Inlet at 125 dB.

5.5.1.1 *Potential Effects of Noise on Beluga Whales*

Marine mammals use hearing and sound transmission to perform vital life functions. Introducing sound into their environment could be disrupting to those behaviors. Sound (hearing and vocalization/ echolocation) serves four primary functions for odontocetes, including: 1) providing information about their environment; 2) communication; 3) prey detection; and 4) predator detection. The distances to which construction noise associated with the Project are audible depend upon source levels, frequency, ambient noise levels, propagation characteristics of the environment, and sensitivity of the receptor (Richardson et al. 1995).

In terms of hearing abilities, belugas are one of the most studied of whales because they are a common marine mammal in public aquaria around the world. Although they are known to hear a wide range of frequencies, their greatest sensitivity is around 10 to 100 kHz (Richardson et al. 1995), well above sounds produced by most industrial activities (<100 Hz or 0.1 kHz) recorded in Cook Inlet. Beluga whales do have some limited hearing ability down to ~35 Hz, where their hearing threshold is about 140 dB (Richardson et al. 1995). Thresholds for pulsed sounds will be higher, depending on the specific durations and other characteristics of the pulses.

5.5.1.2 *Background Noise Environment*

Underwater sound levels in the Port area are comprised of multiple sources, including physical noise, biological noise, and man-made noise. Physical noise includes wind, waves at the surface, currents, earthquakes, ice, and atmospheric noise. Biological noise includes sounds produced by marine mammals, fish, and invertebrates. Man-made noise consists of vessels (small and large), oil and gas operations, maintenance dredging, aircraft overflights, and construction noise. Blackwell and Greene (2002) reported ambient levels, devoid of industrial sounds, at Birchwood of approximately 95 dB to over 120 dB for locations off of EAFB and north of Point Possession. Blackwell (2005) reported background levels, not devoid of industrial sounds, without strong currents of 115 to 118 dB. Background levels with strong currents were measured between 125 and 132 dB. URS Corporation (URS) (2007) reported ambient levels of 105 to 120 dB when no industrial sounds were identified to background levels between 120 and 140 dB when other vessels were operating. Scientific Fishery Systems, Inc. (2009) indicated background levels ranged from 120 to 155 dB, depending heavily on wind speed and tide level.

All of these studies indicate measured background levels are rarely below 125 dB, except in conditions of no wind and slack tide. Thus, although the NMFS harassment zone requirement for non-pulsed noise sources is 120 dB, it is unlikely beluga whales will be able to hear any pile driving noise until it exceeds the background level of 125 dB. Therefore, the analysis of numbers of beluga whales potentially exposed to pile driving noise calculated the area of noise exposure within 125 dB, rather than 120 dB.

5.5.1.3 *Description of Project Noise Sources*

Underwater noise sources associated with the Project include pile driving, vessel operations, and dredging. Underwater noise levels associated with these sources are summarized by Richardson et al. (1995) and have been measured in Cook Inlet by: 1) Blackwell and Greene (2002) for baseline measurements; 2) Blackwell (2005) for pile driving at Port MacKenzie; 3) URS (2007) for test pile driving at the Port; and 4) Scientific Fishery Systems, Inc. (2009) during sheet pile driving at the Port. Table 1 summarizes the noise levels and frequency ranges of these sources.

Table 1. Representative Noise Levels of Sources

Noise Source	Frequency Range (Hz)	Noise Level from Source	Reference
Small vessels	250 – 1,000	151 dB at 1 m	Richardson et al. 1995
Tug docking gravel barge	200 – 1,000	149 dB at 100 m	Blackwell and Greene 2002
Container ship	100 – 500	180 dB at 1 m	Richardson et al. 1995
Dredging operations	50 – 3,000	120 – 140 at 500 m	URS Corporation 2007
Impact driving of 36-inch piles at Port MacKenzie	100 – 1,500	190 dB RMS at 62 m	Blackwell 2005
Vibratory driving of 36-inch piles at Port MacKenzie	400 – 2,500	164 dB RMS at 56 m	Blackwell 2005
Impact driving of 14-inch H-piles at the Port of Anchorage	100 – 1,500	194 dB PEAK at 19 m	URS Corporation 2007
Vibratory driving of 14-inch H-piles at the Port of Anchorage	400 – 2,500	168 dB RMS at 10 m	URS Corporation 2007
Dropping of sheet piles (stabbing) at the Port of Anchorage	data not available	123 dB RMS at 64 m	Scientific Fishery Systems, Inc. 2009
Use of hairpin weight on sheet piles at the Port of Anchorage	data not available	165 dB RMS at 100 m	Scientific Fishery Systems, Inc. 2009
Vibratory driving of sheet piles at the Port of Anchorage	10 – 16,000	141 dB RMS at 757 m	Scientific Fishery Systems, Inc. 2009
Impact driving of sheet piles at the Port of Anchorage	50 – 8,000	167 dB RMS at 301 m	Scientific Fishery Systems, Inc. 2009
Vibratory driving of 30-inch piles at the POA	data not available	144 dB RMS at 35 m	Scientific Fishery Systems, Inc. 2009

5.5.1.4 *Determination of Effect - Impacts to Beluga Whales*

In general, noise associated with coastal development has the potential to harass beluga whales that may be present around the specific action area. Beluga whales use sound for vital life functions, and introducing sound into their environment could be disrupting to those behaviors. Sound (hearing and vocalization/echolocation) serves four main functions for odontocetes (toothed whales and dolphins). These include: (1) providing information about their environment; (2) communication; (3) enabling remote detection of prey; and (4) enabling detection of predators. The distances to which sounds are audible depend on source level and frequency, ambient noise levels, physical habitat characteristics (e.g., water temperature, depth, substrate type), and sensitivity of the receptor (Richardson et al., 1995).

5.5.1.5 *Behavioral Effects*

Behavioral responses of beluga whales to noise are highly variable and depend on a suite of internal and external factors which in turn results in varying degrees of significance (NRC, 2003; Southall et al., 2007). Internal factors include: (1) individual hearing sensitivity, activity pattern, and motivational and behavioral state (e.g., feeding, traveling) at the time it receives the stimulus; (2) past exposure of the animal to the noise, which may lead to habituation or sensitization; (3) individual noise tolerance; and (4) demographic factors such as age, sex, and presence of dependent offspring. External factors include: (1) non-acoustic characteristics of the sound source (e.g., if it is moving or stationary); (2) environmental variables (e.g., substrate) which influence sound transmission; and (3) habitat characteristics and location (e.g., open ocean vs. confined area). There are no consistent observed threshold levels at which beluga whales respond to an introduced sound. Beluga whale responses to sound stimuli have been noted to be highly dependent upon behavioral state and motivation to remain or leave an area. Few field studies involving stationary industrial sounds have been conducted on beluga whales. Reactions of belugas in those studies varied. For example, in Awbrey and Stewart (1983) (as summarized in Southall et al., 2007), recordings of noise from SEDCO 708 drilling platform (non-pulse) were projected underwater at a source level of 163 dB. Beluga whales less than 1.5 km from the source usually reacted to onset of the noise by swimming away (RLs approximately 115.4 dB). In two instances groups of whales that were at least 3.5 km from the noise source when playback started continued to approach (RLs approximately 109.8 dB). One group approached within 300 m (RLs approximately 125.8 dB) before all or part turned back. The other group submerged and passed within 15m of the projector (RL approximately 145.3 dB). Richardson et al. (1990), as summarized in Southall et al., 2007, played back drilling platform sounds (source level: 163 dB) while approximately 100 belugas were in the area of several hundred meters to several hundred kilometers. No obvious reactions were noted; however, moderate changes in behavior from three groups swimming within 200 m of the sound projector were observed. TTS experiments have also documented behavioral responses by trained belugas. These responses included reluctance to return to experimental stations when exposed to watergun pulse sounds projected 4.5m from the subject at approximately 185.3 dB (171 dB re 1 μPa2-s [SEL]) (Finneran et al., 2002) and behavioral changes when exposed to sounds from the explosion simulator at approximately 200 dB (177 dB re 1 μPa2-s [SEL]) (Finneran et al., 2000). In a non-pulse exposure experiment, belugas displayed altered behavior when exposed to 180-196 dB (180-196 dB re 1 μPa2-s [SEL]) (Schlundt et al., 2000).

Masking of whale calls or other sounds potentially relevant to whale vital functions may occur. Southall et al. (2007) defines auditory masking as the partial or complete reduction in the audibility of signals due to the presence of interfering noise with the degree of masking depending on the spectral, temporal, and spatial relationships between signals and masking noise as well as the respective received levels. Masking occurs when the background noise is elevated to a level which reduces an animal's ability to detect relevant sounds. Belugas are known to increase their levels of vocalization as a function of background noise by increasing call repetition and amplitude, shifting to higher frequencies, and changing structure of call content (Lesage et al., 1999; Scheifele et al., 2005; McIwem, 2006). Another adaptive method to combat masking was demonstrated in a beluga whale which reflected its sonar signal off the water surface to ensonify an object on which it was trained to echolocate (Au et al., 1987). Due to the low frequencies of construction noise, intermittent nature of pile driving, and the ability of belugas to adapt vocally to increased background noise, it is anticipated that masking, and therefore interruption of behaviors such as feeding and communication, will be minimized.

Many marine mammals, including beluga whales, perform vital functions (e.g., feeding, resting, traveling, socializing) on a diel (i.e., 24 hr) cycle. Repeated or sustained disruption of these functions is more likely to have a demonstrable impact than a single exposure (Southall et al., 2007). However, it is possible that marine mammals exposed to repetitious construction sounds from the proposed construction activities will become habituated and tolerant after initial exposure to these sounds, as demonstrated by beluga vessel tolerance (Richardson et al., 1995, Blackwell and Green, 2002). Habituation is found to be common in marine mammals faced with introduced sounds in their environment. For example, bowhead whales (Balaena mysticetus) have continued to use pathways where drilling ships are working (RLs: 131 dB) so that they can continue their eastward migration (Richardson et al., 1991). In addition, harbor porpoise, dolphins, and seals have become habituated to acoustic harassment deterrent devices such as pingers and seal bombs after repeated exposure (Mate and Harvey, 1987; Cox et al., 2001).

The monitoring program implemented by the POA/MARAD, with guidance and approval from NMFS, is designed to determine acute behavioral reactions of marine mammals in response to MTR project activities as well as implement shut down mitigation measures. To do this, marine mammal observers (MMOs) are and would continue to be stationed at the Port of Anchorage near pile driving operations to make observations and notify hammer operators of presence of marine mammals and if shut down is required. From July to November 2008, MMOs were on site all days in-water pile driving occurred (6-7 days per week). Reports indicate that 431 beluga whales (231 adults, 101 juveniles, 43 calves, 56 unknown age) and 1 harbor seal were sighted by MMOs stationed at the POA from July- November 2008. Of the 431 whales sighted, 267 entered into the harassment or safety zone; however, pile driving was not always taking place due to either non-mandatory, early shut-down or in-water pile driving not being conducted. This trend of using the east side of Knik Arm is consistent with marine mammal survey reports from 2005-2007. The POA/MARAD have consistently shut down operations if whales were sighted within or approaching the POA; therefore, only 8 beluga whales have entered into the designated harassment zones when pile driving was actually occurring. Traveling was the most common behavior detected followed by possibly feeding and resting/milling, augmenting data collected from 2005-2007. Out of 59 group sightings totaling 431 beluga whales, only 3 groups demonstrated an observed change in behavior. On all 3 occasions, the group split in two due to presence of a barge or a boat. Beluga whales were not observed to change swim speeds and while heading occasionally did change, this could not be attributed directly to pile driving.

There were no available data on beluga whale responses to pile driving before in-water pile driving began for the MTR Project; therefore, NMFS used the best available science which investigated similar sounds involving mid frequency cetaceans to assess potential impacts to beluga whales when exposed to pile driving during its impacts analysis for issuance of an incidental harassment authorization pursuant to the Marine Mammal Protection Act in 2008. In general, scientific literature suggests the following reactions are the most common in such cases: altered headings, increased swimming rates, changes in dive, surfacing, respiration, and feeding patterns, and changes in vocalizations. NMFS acknowledges these reactions are possible; however, also notes that, to date, all monitoring reports show no apparent behavioral reaction of Cook Inlet beluga whales to pile driving. There could be a number of reasons for this, including, but not limited to: (1) Cook Inlet beluga whales have demonstrated a tolerance to commercial vessel traffic and industrialization around the POA and therefore, may simply be habituated to such noise; (2) Cook Inlet is a naturally noisy environment due to strong winds and tides; (3) pile driving is intermittent in nature and a stationary source which may alleviate stress and reactions; and (4) the mitigation measures set by NMFS and implemented by the POA/MARAD are appropriate and effective to minimize harassment. Again, to date, all monitoring reports indicate no change in frequency, habitat use, or behavior of whales exposed to pile driving activities.

One of the current BMPS (ICRC, 2010) for PCEs 4 and 5 is a mandatory shut down if a beluga whale calf or group with a calf is sighted approaching or within the harassment isopleths. Scientific literature suggests that mammal calves are more susceptible to anthropogenic stressors (e.g., noise) than adults. Frankel and Clark (1998) investigated the relative importance of natural factors such as demographic composition of humpback whale pods in response to low frequency (75Hz with a 30Hz bandwidth) M-sequenced source signal transmitted from a 4-element hydrophone array (elements were placed at depths of 10, 20, 40, and 80m). They determined that two natural variables, the number of adults in a pod and the presence of a calf, had the greatest effect upon whale behavior in response to playbacks. Pods with calves had higher blow rates, longer times at the surface, and a higher ratio of time at the surface to time submerged. The presence of a calf; however, did not affect whale speed, whale bearings, or relative orientation to the playback vessel. While no data on the vocal responses of beluga whales' mother/calf pairs in response to anthropogenic sound are available, Van Parijs and Corkeron (2001) concluded that that Indo-Pacific humpback dolphin mother/calf pairs appear to be more disturbed by vessel noise than animals of other social/age classes and that mother/calf pairs exhibit an increased need to establish vocal contact after such disturbance. McIwem (2006) suggested that pile driving operations should be avoided when bottlenose dolphins are calving as lactating females and young calves are likely to be particularly vulnerable to such sound.

Kendall (2010) completed a study to investigate construction impacts on the Cook Inlet beluga whale at the POA MTR project using visual and acoustic observations. She examined the behavior and distribution of whales before and during pile driving activity at the MTR project by comparing sighting duration; behavioral states, group size, composition, and formation; and distribution. She also observed vocalizations at the MTR project site.

Her results showed differences in these variables between pre-construction and construction phases. While group size was similar, there was a declining trend. Beluga whales were most frequently distributed along the eastern shoreline in both situations, but there was an increase in sightings along the western shoreline near Port MacKenzie (opposite of the MTR project) during pile driving. Sighting duration decreased during construction, although Kendall says it may be due to difficulty in observing smaller group sizes. Traveling increased while all other activity decreased. These factors may indicate a shift in behavior from diving and feeding to traveling through the area.

All group formation categories increased during pile driving activity; however, densely packed groups were most commonly observed during construction. This could be expected in order to maintain communication in a noisy environment. This behavior has been documented in beluga, bowhead, and sperm whales in the presence of anthropogenic noise (Ljungblad et al 1988, Blane and Jaakson 1994, Patenaude et al 2002). Also, while beluga whales traveled more frequently along the eastern shoreline before and during pile driving activity, sightings near Port MacKenzie increased during construction. This could indicate beluga whales are minimizing their exposure to construction noise.

No call types besides echolocation clicks were detected from beluga whales during the study. The observed click rate was higher before construction, but the difference was not statistically significant. Kendall offers that the lack of other calls (whistles and noisy vocalizations) could be explained by one of three scenarios:

(1) Those other vocalizations were being masked by the construction noise,
(2) Beluga whales were vocalizing less during construction activity, or
(3) Overall there was a decrease in abundance of beluga whales near the construction area.

As part of a collaborative effort began in 2007 to aquire new information on the seasonal presence of beluga whales throughout Cook Inlet using passive acoustic monitoring, Small et al (2010) report that noise from water flow, shipping traffic, and industrial activities varied among locations and often made beluga call detection challenging due to masking and that detection of beluga calls was surprisingly low at Cairn Point, considering Cook Inlet beluga whales must pass this site in transit to, and from, Knik Arm. Cairn Point is the noisiest of the monitored locations due to heavy industrial activity, so more masking may occur there; alternatively, belugas may suppress calling while in this area.

Kendall hypothesizes that beluga whales are not using whistles and noisy vocalizations because the construction noise would interfere with their ability to detect these call types. This type of communication is necessary for conspecific socialization (Faucher 1988, Richardson et al 1995, Karlsen et al 2002, Belikov and Bel-kovich 2006, 2007, 2008). Without it, their ability to maintain group formation could be affected and their predator defense, cooperative foraging strategies, and reproductive success could be decreased. While little is known about the vocal behavior of the Cook Inlet beluga whale, beluga whales in Norway have ceased vocal activity in the presence of vessel noise (Karlsen et al 2002).

Kendall suggests examining behavior and distribution of beluga whales after exposure to determine if there are long-term effects, such as displacement from Knik Arm. The whales' range has contracted over the last three decades to the upper reaches of Cook Inlet, and they are currently concentrated heavily in Knik Arm. It is considered Type I critical habitat (foraging and nursery areas) and NMFS believes the shallow waters of Knik Arm provide protection from predators, such as killer whales (*Orcinus orca*) (NMFS 2008). Displacement from this area could be extremely detrimental to their survival.

5.5.1.6 ***Conclusion***

NMFS has determined that noise from the port expansion project may adversely affect PCE #5 of critical habitat for Cook Inlet beluga whales. In general, scientific literature suggests the following reactions are the most common with exposure to anthropogenic noise: altered headings, fast swimming, changes in dive, surfacing, respiration, feeding patterns, and changes in vocalizations. Death and injury are recorded but very rare, and associated with much higher source levels than presented by the proposed dredging. Though most monitoring reports from the Port show no apparent observable reaction of Cook Inlet beluga whales to construction noises, new research shows some differences in behavior before and during construction. There could be a number of reasons for this, including, but not limited to: 1) Cook Inlet beluga whales have demonstrated a tolerance or adaptation to commercial vessel traffic and industrialization around the Port and may be habituated to such noise; 2) Cook Inlet is a naturally noisy environment which raises ambient sound levels; 3) beluga responses to construction and dredging are not detectable by existing data collection methods; and 4) the need to meet certain life history requirements, such as acquiring food, overrides avoidance reactions. Opportunistic sighting reports and those from marine mammal observations describe accounts of beluga whales vocalizing around tugs and barges, swimming near and around ships, and feeding around working vessels and newly filled land. However, recent studies picked up no vocalizations around the port. While beluga whales will be exposed to greater than background noise during construction, background sound levels in Knik Arm are already higher than most other marine and estuarine systems due to strong currents and eddies, wind, recreational vessel traffic, and commercial shipping traffic entering and leaving the Port. It is unlikely that belugas would alter their behavior in a way that prevents them from entering and/or transiting throughout Knik Arm causing abandonment of critical habitat. This conclusion is supported by the fact that construction, particularly dredging, has been an annual event at the Port of Anchorage for decades, during which time NMFS has consistently recorded the presence of beluga whales in these waters.

INDIRECT EFFECTS

Vessel Traffic

The carrying capacity of the Port is currently at or exceeding the facility capabilities. The function of the PIEP is to better accommodate current vessel traffic, to accommodate newer and larger vessels, and provide additional facilities necessary to support military deployments. While expansion at the Port will allow accommodation of larger commercial vessels, sighting data at the Port demonstrate beluga whales are able to navigate around the types of slow moving vessels served at the Port.

Even though vessel traffic has remained relatively consistent in numbers of ships over the past ten years, the total number of Port calls has decreased somewhat over the past four years. A significant factor in the change in number of calls is that many of the cargo vessels now being used are larger than in previous years and make more efficient use of deck space to carry more cargo. The recent reduction in vessel traffic not only reduces the likelihood of ship strikes, but also reduces underwater noise. The new, larger vessels are also safer regarding potential water pollution since they have a double hull surrounding the fuel compartments, redundant propulsion and navigation systems, and have a fresh water ballast system with no discharge to the environment. The Conservation Plan for the Cook Inlet Beluga Whale states large vessels are not expected to pose a significant threat to beluga whales due to their lower speed and straight-line movement (NMFS, 2008).

The risk of accidental spills will temporarily increase as a result of increased vessel traffic when maintenance and transition dredging is taking place at the same time. The increased risk will be relatively small and will be minimized through enforcement of standard Port operational controls that maintain safe operational and navigation conditions. Compliance with established contingency plans will limit impacts if there were an accidental spill.

Pollution and Water Quality

The Conservation Plan for the Cook Inlet Beluga Whale (NMFS 2008) states contaminants are a concern for the sustained health of Cook Inlet beluga whales. According to Moore et al. (2000), there are four main categories of marine pollution: 1) discharges from industrial activities that do not enter municipal treatment systems; 2) discharges from municipal wastewater treatment systems; 3) runoff from urban, mining, and agricultural areas; and 4) accidental spills or discharges of petroleum and other products. Based on these categories, Project-related mechanisms identified as having the potential to impact pollution levels within the Project action area and; therefore, potentially affect Cook Inlet beluga whales are contaminated storm water runoff from the Port, and hazardous material and/or oil spills from the Port and/or vessels. Dredged materials could also result in the impairment of water quality. However, chemical analysis of dredging sediments in 2003 found that pesticides, PCB's, and petroleum hydrocarbons were below detection limits, while levels of arsenic, barium, chromium, and lead were well below management levels (USCOE 2003). Cadmium, mercury, selenium, and silver were not detected. It does not appear that dredging or disposal of dredged sediments is currently a significant stressor on Cook Inlet beluga whales.

Exposure to pollution is a concern for many species which inhabit anthropogenically-influenced areas. Pollutants may enter Cook Inlet via wastewater, runoff, and accidental petroleum and other product spills. The city of Anchorage and lower Knik Arm is the most highly industrialized area of Cook Inlet; however, pollution levels in beluga whales are lower than those in other populations of beluga whales. As summarized in the Conservation Plan, beluga whale tissue samples have been analyzed for polychlorinated biphenyl (PCBs), chlorinated pesticides (such as DDT), and heavy metals. PCBs and DDT may impair marine mammal health and reproductive abilities. Cook Inlet beluga whales had much lower concentrations of PCBs and DDT than Saint Lawrence river beluga whales and about 1/2 the concentration of those pollutants than other Arctic Alaska populations. Also examined were concentrations of various substances stored in the liver. Cadmium and mercury were lower in the Cook Inlet population than in the Arctic Alaska populations, while levels of methyl mercury were similar to other Arctic Alaska populations. Copper levels were two to three times higher in the Cook Inlet animals than in the Arctic Alaska animals and similar to the Hudson Bay animals; however, the copper levels found in the livers of Cook Inlet belugas were not high enough to be a health issue (Becker et al., 2000).

As a result of POA expansion, dredging needs are altered from the current nominal depth of -35 ft MLLW to -45 ft MLLW and therefore NMFS has analyzed the potential for impact to marine mammals from this change in dredging needs in addition to POA/MARAD operated construction dredging. The Conservation Plan states that direct chemical analysis of dredging sediments found that compounds such as pesticides, PCBs, and petroleum hydrocarbons in Cook Inlet were well below detection limits while levels of arsenic, barium, chromium, and lead were well below management levels. Other compounds such as cadmium, mercury, and silver were not detected at all. In addition, hydrological models indicate that, overall, the POA expansion appears to have less potential for sedimentation than the existing port since the MTR Project moves the dock face out into deeper water and into a higher flow regime area (Erbesole and Raad, 2004) leading to a possible decrease in dredging needs.

Storm Water Runoff from the Port

The construction activity most likely to affect storm water runoff is the backfilling of sheet piles to create the new Port acreage. A total of 9.5 million cy of fill is planned to be added to create lands, and is being taken from one of two borrow sites on EAFB. Preventative storm water runoff mitigation measures are in place, as prescribed by the NPDES Construction General Permit granted by the EPA. Currently, the POA implements an aggressive pollution prevention program as part of the POA's storm water management plan and construction activities under its jurisdiction. Only certified clean government-furnished fill material is being used, and the fill is further screened to ensure compliance with stringent specifications for grain size, and laboratory tested to ensure all material is contaminant-free.

The POA has a drainage system that includes six below ground drain systems and one open ditch system within the Port drainage basin. These systems drain all 129 acres of the Port's current area in addition to large portions of adjacent EAFB, and all discharge into Knik Arm. One of the Project components includes the installation of additional storm drain systems and oil/grit/water separators to treat existing drainage from the Port, EAFB, and runoff from newly constructed impervious areas. As a result of these additions, water quality will be improved since the existing storm drain system at the Port does not currently treat storm water discharges in Knik Arm. Current BMPs in place at the Port to limit potential pollution include: general litter control and cleanup; annual sweeping of parking areas; periodic inspections; construction and post-construction storm water quality controls; restrictions on the use of pesticides; herbicides, and fertilizers; and training of employees to prevent spills. Additionally, the Port does not use chemical means to clear snow in the winter.

Although very little is known about the impacts of pollution on beluga whales, what little research has been conducted suggests the Cook Inlet stock has been historically unaffected by contaminants. Tissue samples taken since 1992 from subsistence harvested and stranded Cook Inlet beluga whales have been tested for numerous contaminants and compared to results obtained from beluga whale populations in the Arctic and the St. Lawrence River. Results have consistently yielded lower concentrations in the Cook Inlet population for PCBs, chlorinated pesticides (such as DDT), and heavy metals (Becker et al. 2000).

Because of the stringent requirements for fill used in Port construction, existing BMPs, and the improvement in water quality expected to result from an improved storm water system, the direct and indirect effects of the Project on water quality levels in Knik Arm from storm water discharge are considered insignificant and discountable.

Hazardous Materials and Oil Spills from the Port and Vessels

Oil spills from vessel traffic and Port activities are a possibility throughout the duration of the construction phase and during ongoing Port operations. To prevent oil spills or accidental releases of hazardous materials, the POA has a series of BMPs in place. As stated in the MTR EA (Maritime Administration 2005): "Management of hazardous materials and waste [including POLs] at the POA is conducted by POA personnel and other POA users, including operators of lease facilities. Although lessees and other POA users are responsible for complying with all rules and regulations applicable to their facilities and operations, the POA confirms that those users comply with applicable permits and regulations via lease agreements and active oversight of POA users."

Active oversight of POA users includes (pers. comm., Dozookian):

- The POA performs required, routine maintenance inspections of the petroleum facilities.
- The US Coast Guard performs periodic and unannounced drills at the petroleum facilities.

- All users of the petroleum facilities are required to retain on-site monitors for the duration of every ship fuel transfer, whether coming into or leaving the Port.
- Clarify that each tenant has their own hazardous materials management plan and must comply with their own company guidelines and requirements.
- The POA does not actively audit all user operations; the Port users are responsible for that.
- The POA actively oversees all dock operations when hazardous materials are involved (e.g. when containers are being offloaded). This includes periodic container inspections.
- The POA safety officer is on scene for any spill that is reported by users and also for any reported by POA personnel.

No significant spills and leaks have occurred at the Port or lessee facilities since 1999. Although limited amounts of hazardous waste are generated at the Port from equipment and vehicle maintenance by either the Port or tenant operations, the POA plans no introduction of new types of hazardous materials or waste during construction, and no releases of hazardous substances or oil are authorized from the construction site. The projected increase in Port operations after implementation of the proposed action will result in an increase in POL throughput and use. However, expanded draft and increased dock length with new cranes will allow newer ships, built with more stringent environmental controls, to call on the expanded Port, mitigating the potential for an increase in spills with expanded operations.

Should an oil spill occur, the effects on beluga whales are generally unknown. Research has shown that while cetaceans are capable of detecting oil they do not seem to be able to avoid it (Geraci 1990). The potential impacts on beluga whales caught in an oil spill include: skin contact with oil; ingestion of oil; respiratory distress from hydrocarbon vapors; contaminated food sources; and displacement from feeding areas. The actual impacts would depend on the extent and duration of contact, and the characteristics (type and age) of the oil. Cook Inlet beluga whales could be affected by residual oil from a spill even if they were not present during the oil spill, due to the highly mobile nature of the spill and the drastic tidal fluctuations in the area (NMFS 2008).

Given the mitigation measures in place at the Port and by its tenants and visiting vessels, and the established record of compliance at the Port, the potential for Project-related activities to have direct or indirect effects on Cook Inlet beluga whales through pollution from storm water discharge, oil spills, or accidental release of hazardous material during construction and operation at the Port is considered insignificant and discountable. Therefore, pollution and water quality impacts related to the Project may affect, but are unlikely to adversely affect, the critical habit of Cook Inlet belugas.

6.0 CUMULATIVE EFFECTS

Cumulative effects are defined in 50 CFR §402.02 as: "...those effects of future State or private activities not involving Federal activities that are reasonably certain to occur within the action area of the Federal action subject to consultation." Reasonably foreseeable future Federal actions and potential future Federal actions that are unrelated to the proposed action are not considered in the analysis of cumulative effects because they would require separate consultation pursuant to section 7 of the ESA. Most structures and major activities within the range of the Cook Inlet beluga whale require Federal authorizations from one or more agencies, such as the Army Corps of Engineers, Environmental Protection Agency, and MMS. Such projects require consultation under the ESA on their effects to the Cook Inlet beluga whale, and are therefore not addressed here as cumulative impacts.

There have been several past State oil and gas lease sales in the Inlet. Future sales are anticipated annually; the Cook Inlet Sale 2009 will offer 4.2 million acres for lease, including much of the submerged lands of Cook Inlet. While these sales are State matters, many or most of the subsequent actions that might impact beluga whales are likely to have some federal nexus. Location of drilling structures would require authorization from the Corps. Discharges such as muds and cuttings or produced waters require permitting through the EPA. Oil spills would be one example of an unauthorized activity. In the event an oil spill occurred on State leases in Cook Inlet, the effects of an oil spill on beluga whales would the same as those described earlier in this document. These effects include inhalation of hydrocarbon vapors, possible loss or contamination of prey, ingestion of contaminated prey, and skin and/or sensory organ damage. These effects could lead to death and would be most pronounced whenever whales were confined to an area of freshly spilled oil. Of course, if the spill occurred over a prolonged period of time, more individuals could come into contact with the spilled oil.

Activities that are not oil and gas related could also continue to affect beluga whales, although the incidental take of beluga whales associated with such activities is uncommon. The low number of observed ship-strike injuries suggests that belugas either do not often encounter vessels, they avoid interactions with vessels, or that interactions usually result in the unobserved death of the animals.

6.1.1.1 ***Ship Creek***

Ship Creek is a popular area for recreational fishing in Anchorage, and currently has a small boat launch located at its mouth. Plans for the Ship Creek area include continued use of the harbor for recreational fishing and small boat traffic, construction of a loading facility for the Cook Inlet ferry service, and habitat improvements to mitigate the effects of the MTR Project.

Small vessel activity and the use of a ferry near the mouth of Ship Creek can increase noise disturbance and the risk of ship strikes to beluga whales. The improvements made at the Ship Creek harbor may increase its use by small boats. Noise levels will increase during construction of the ferry terminal and as habitat improvements are being made. Any habitat improvements to the Ship Creek watershed will help to reduce the amount of pollution from runoff entering the Knik Arm, which will help to improve beluga whale habitat.

6.1.1.2 *Tourism/Whale Watching*

There currently are no boat-based commercial whale-watching companies in upper Cook Inlet. The popularity of whale watching and the close proximity of beluga whales to Anchorage make it possible that such operations may exist in the near future. However, it is unlikely this industry will reach the levels of intensity seen elsewhere because of upper Cook Inlet's climate and navigation hazards (e.g., shallow waters, extreme tides, and currents).

Vessel-based whale-watching may cause additional stresses to the beluga population through increased noise and intrusion into beluga habitat not ordinarily accessed by boats. Avoidance reactions have often been observed in belugas when approached by watercraft, particularly small, fast-moving craft that are able to maneuver quickly and unpredictably; larger vessels which do not alter course or motor speed around these whales seem to cause little, if any, reaction (NMFS 2008). The small size and low profile of belugas, and the poor visibility within the Cook Inlet waters, may increase the temptation for whale-watchers to approach the belugas more closely than usually permitted for marine mammals. General marine mammal viewing guidelines would be adopted, and possibly enhanced, for any commercial beluga whale watching tours.

6.1.1.3 *Pollution*

There are many non-point sources of pollution within the action area; such pollution is not federally-regulated. Pollutants can pass from streets, construction and industrial areas, and airports into Ship Creek, Chester Creek, and Fish Creek and then into beluga whale habitat within the action area. The potential for pollution from all sources will increase with population growth, more development, and new commercial activities in upper Cook Inlet.

Hazardous materials can potentially be released from vessels, aircraft, the Port, Port Mackenzie, or EAFB. There is a possibility an oil spill could occur from vessels traveling within the action area, or that oil will migrate into the action area from a nearby spill. The effects of oil spills on beluga whales are generally unknown; however, some generalizations can be made regarding impacts of oil on individual whales based on present knowledge. Although cetaceans are capable of detecting oil, they do not seem to avoid the oil (Geraci 1990). Belugas swimming through an oil spill could be affected in several ways: skin contact with the oil, ingestion of oil, respiratory distress from hydrocarbon vapors, contaminated food sources, and displacement from feeding areas. Actual impacts would depend on the extent and duration of contact, and the characteristics (type and age) of the oil.

The Port and its tenants have pollution prevention plans in place to help identify potential sources of pollution, and to minimize the risk of spills and releases of contaminants. The Port has plans to improve water quality by treating the storm water discharges that pass from the Port into the Knik Arm.

6.1.1.4 *Conclusion*

While these factors may affect Beluga whale critical habitat, they are not expected to destroy or adversely modify it.

7.0 CONCLUSIONS

This Biological Opinion has considered the direct, indirect, and cumulative effects of the Port of Anchorage expansion project on critical habitat of the Cook Inlet beluga whale. The proposed action is expected to result in direct and indirect impacts to critical habitat. After construction, some whales will be exposed to increased noise due to operation of the Port. It is unlikely this exposure would cause injury or mortality, although individual whales may alter their behavior for a brief period of time. The operational noise signature of the expanded port may not exceed current levels. The expanded port will allow larger ships with fewer calls, may require less maintenance dredging, and will employ engineering designs intended to lessen noise. NMFS has recommended the POA consider such engineering in their final designs, although no specific recommendations have been developed at this time.

It is possible that whales, on exposure to construction and operational noise from the port, may use the project area less than they did prior to the existence of the port. We have no data on the historic numbers or occurrence of beluga whales in this area. It is similarly possible whales have become acclimated to at least some levels of noise from the port, as observer data suggest. Finally, we note that the specific habitat value of the action area appears to be primarily as a transportation corridor between valuable habitats, and less so for feeding. Any possible diminished use of the area would not have the potential adverse consequence expected for harassment within high-value feeding or calving habitat.

After reviewing the environmental baseline for the action area, the effects of the proposed action including the conservation measures, and the cumulative effects, it is NMFS' biological opinion that the action, as proposed, is not likely to destroy or adversely modify Cook Inlet beluga whale critical habitat. Although PCE #5 may be adversely affected, it is NMFS' opinion that critical habitat will remain functional and able to serve its intended conservation role for Cook Inlet beluga whales.

7.1.1.1 ***Conservation Measures***

Table 3 details the best management practices (BMPs) that the action agency identified in the BA (ICRC 2010). These BMPs have been adopted here as part of the proposed action. NMFS considers the action to include the continued practice of the BMPs listed as "ongoing" in Table 3. We believe these measures will lessen the effects of the project on critical habitat of Cook Inlet beluga whales. Further, such measures may be associated with conditions necessary for authorization of this work under section 101(a)(5) of the Marine Mammal Protection Act.

Table 3. - Current Best Management Practices Applied to the Primary Constituent Elements at the PIEP. Source: ICRC 2010.

#	Primary Constituent Elements (PCEs)	Best Management Practices (BMPs)	In-water Heavy Machinery Dredging	In-Water Pile Driving Impact & Vibratory	Project General	BMP Status
1	PCEs #1 through #5	Team Briefing	X	X	X	Ongoing
2	PCE #1 Intertidal and subtidal waters <30 feet, within 5 miles of high and medium flow fish streams	Stabilize fill	X			Ongoing
3	PCE #2	Compensatory Mitigation program			X	Ongoing
4	PCE # 2 Primary Prey Species[1]	Live Caged Fish Study		X		Completed in 2009
5	PCE #2[1]	No work within 1 week of smolt release(s)	X	X		Ongoing
6	PCE #2[1]	Monitor dock joint fish refuges; 2 years post construction			X	Refuges designed Monitoring planned
7	PCE #2[1]	No impact pile driving within 2 hours of low tide		X		Ongoing
8	PCE #3 Absence of toxins or other agents of a type or amount harmful to beluga whales	Clean fill	X			Ongoing
9	PCEs #4 & #5 Unrestricted passage and Absence of in-water noise at levels resulting in the abandonment of habitat	Notify NMFS prior to start. Submit weekly and monthly monitoring reports.		X		Ongoing

10	PCEs #4 & #5	Final monitoring report; 1 year post construction			X	Planned
11	PCEs #4 & #5	Soft start		X		Ongoing
12	PCEs #4 & #5	Drive sheet piles with vibratory to maximum extent		X		Ongoing
13	PCEs #4 & #5	Safety Zone 200 m mandatory shut down		X		Ongoing
14	PCEs #4 & #5	Large Group >5 whales; shut down at isopleths[2]		X		Ongoing
15	PCEs #4 & #5	Whales Calves mandatory shutdown at isopleths[2]		X		Ongoing
16	PCEs #4 & #5	Safety Zone 50 m mandatory shut down	X			Ongoing for MTR
17	PCEs #4 & #5	If authorized takes reached, mandatory shutdown at Isopleths [2]		X		Understood
18	PCEs #4 & #5	Visibility Requirement		X		Ongoing
19	PCEs #4 & #5	Acoustic Study/Sound Index. Engineering report 2 years prior to completion.	X	X		Acoustic Research Complete Engineering Report Ongoing
20	PCEs #4 & #5	Marine Mammal Monitoring - Construction	X	X	X	Monitoring Ongoing
21	PCEs #4 & #5	Marine Mammal Monitoring - Scientific and 1 year post	X	X		Monitoring Ongoing Post Monitoring

		construction				Planned
22	PCEs #4 & #5	Annual Summary Monitoring Report	X	X		2008 - 2009 Complete Ongoing
23	PCEs #4 & #5	Public Outreach: Signage for whale sighting notification			X	Complete
24	PCEs #4 & #5	Public Outreach: Establish long term sighting/reporting procedures			X	Complete Documentation Ongoing
25	PCEs #4 & #5	Passive Acoustic Monitoring (PAM) study	X	X		PAM Completed in 2009

[1] = Primary prey species consisting of four (4) species of Pacific salmon (Chinook, sockeye, chum, and coho), Pacific eulachon, Pacific cod, walleye pollock, saffron cod, and yellowfin sole

[2] = Under the current NMFS LOA permit, the 160 dB isopleth is at 350 m for impact pile driving; the 125 dB isopleth is at 1,300 m for vibratory pile driving and chipping. The current NMFS LOA permit authorizes 34 beluga whale takes.

8.0 CONSERVATION RECOMMENDATIONS

Section 7(a)(1) of the ESA directs Federal agencies to utilize their authorities to further the purposes of the Act by carrying out conservation programs for the benefit of endangered and threatened species. Conservation recommendations are discretionary agency activities to minimize or avoid adverse effects of a proposed action on listed species or critical habitat, to help implement recovery plans, or to develop information.

As part of the 2010 no jeopardy Biological Opinion (NMFS 2010), the National Marine Fisheries Service recommended that MARAD assist the Port of Anchorage in measuring and characterizing the construction and operation noise associated with the POA, develop a "sound index" to accurately represent noise levels, and develop an engineering report that identifies structural and operational noise reduction measures to minimize noise levels to the maximum extent practicable. The recommendation is also relevant to PCE #5 in critical habitat of Cook Inlet beluga whale.

9.0 REINITIATION NOTICE

This concludes formal consultation on the POA expansion. After adoption of this biological opinion, the Federal agency shall request reinitiation of consultation if: (1) the amount or extent of incidental take is exceeded; (2) new information reveals effects of the agency action that may affect the species or critical habitat in a manner or to an extent not considered in this biological opinion; (3) the agency action is subsequently modified in a manner that causes an effect to the species or critical habitat that was not considered in this biological opinion; or (4) a new species is listed or critical habitat designated that may be affected by the action.

There is no Incidental Take Statement associated with this biological opinion on effects to critical habitat, since it is only analyzing affects to critical habitat and not the population of Cook Inlet Belugas.

10.0 LITERATURE CITED

Abookire, A. A., and J. F. Piatt. 2005. Oceanographic conditions structure forage fishes into lipid-rich and lipid-poor communities in lower Cook Inlet, Alaska, USA. Mar. Ecol. Prog. Ser. 287:229-240.

ADFG (Alaska Department of Fish and Game). 2004. Fish Distribution Database – Interactive Mapping. <www.sf.adfg.state.ak.us/sarr/FishDistrib/FDD_ims.cfm>. Accessed October 2006.

Becker, et al. 2000. (P.R. Becker, M.M. Krahn, E.A. Mackey, R. Demiralp, M.M. Schantz, M.S. Epstein, M.K. Donais, B.J. Porter, D.C.G. Muir, and S.A. Wise.) Concentrations of Polychlorinated Biphenyls (PCBs), Chlorinated Pesticides, and Heavy Metals and Other Elements in Tissues of Belugas, *Delphinapterus leucas*, from Cook Inlet, Alaska. March. Fish. Rev. 62(3):81–98.

Belikov, RA and VM Bel'kovich. 2006. High pitched tonal signals of beluga whales *(Delphinapterus leucas)* in a summering assemblage off Solovetskii Island in the White Sea. *Acoustical Physics* 52:125-131.

Belikov, RA and VM Bel'kovich. 2007. Whistles of beluga whales in the reproductive gathering off Solovetskii Island in the White Sea. *Acoustical Physics* 53:528-534.

Belikov, RA and VM Bel'kovich. 2008. Communicative pulsed signals of beluga whales in the reproductive gathering off Solovetskii Island in the White Sea. *Acoustical Physics* 54:115-123.

Blackwell, S.B 2005. Underwater Measurements of Pile-driving Sounds During the Port MacKenzie Dock Modifications. August 13 through 16, 2004. Report from Greeneridge Sciences, Inc., Goleta, California and LGL Alaska Research Associates, Inc., Anchorage, Alaska. In association with HDR Alaska, Inc., Anchorage, Alaska; for Knik Arm Bridge and Toll Authority, Anchorage, Alaska; Department of Transportation and Public Facilities, Anchorage, Alaska; and Federal Highway Administration, Juneau, Alaska. 33 p.

Blackwell, S.B. and C.R. Greene, Jr. 2002. Acoustic measurements in Cook Inlet, Alaska, during 2001. Report from Greeneridge Sciences, Inc., Aptos, CA, for NMFS, Anchorage, AK.

Braham, H.W. 1984. Review of reproduction in the white whale, delphinapterus leucas, narwhal, Monodon monoceros, and irrawaddy dolphin, Orcaella brevirostris, with comments on stockassessment. Rep. Int. Whal. Spec. Issue 6:81-89.

Burns, J.J., and G.A. Seaman. 1986. Investigations of belukha whales in coastal waters of western and northern Alaska. II. Biology and ecology. U.S. Dept. Commer., NOAA, OCSEAP Final Rep. 56(1988): 221-357.

Calkins, D.G. 1983. Susitna hydroelectric project phase II annual report: big game studies. Vol. IX, belukha whale. ADFG, Anchorage, Alaska. 15p.

Cohen, D. M., T. Inada, T. Iwamoto, and N. Scialabba. 1990. FAO species catalogue. Vol. 10. Gadiform fishes of the world (Order Gadiformes). An annotated and illustrated catalogue of cods, hakes, grenadiers and other gadiform fishes known to date. FAO Fisheries Synopsis 10 (125):1-442.

Cornick, L.A. and L.S. Kendall 2008. Distribution, Habitat Use, and Behavior of Cook Inlet Beluga Whales in Knik Arm, Fall 2007. Final Annual Report for 2007 from Alaska Pacific University. Prepared for Integrated Concepts & Research Corporation, Anchorage, Alaska.

Cornick and Saxon-Kendall 2009. End of Construction Season 2008 Marine Mammal Monitoring Report: Construction and Scientific Marine Mammal Monitoring Associated with the Port of Anchorage Marine Terminal Redevelopment Project. Final Annual Report for 2008 from Alaska Pacific University. Prepared for Integrated Concepts & Research Corporation, Anchorage, Alaska.

Cox, T.M, Read, A.J., Solow, A. & Tregenza, N. 2001. Will harbour porpoises *(Phocoena phocoena)* habituate to pingers? Journal of Cetacean Research and Management: 81-86.

[DFO] Department of Fisheries and Oceans, Canada and World Wildlife Fund, Canada. 1995. Saint Lawrence beluga whale recovery plan. Saint Lawrence beluga whale recovery team. 73p.

Faucher, A. 1998. The vocal repertoire of the St. Lawrence Estuary population of beluga whale *(Delphinapterus leucas)* and its behavioral, social, and environmental contexts. MS Thesis, Dalhousie University, Halifax, Nova Scotia.

Fay, R.R. 1988. Hearing in vertebrates: a psychophysics databook. Winnetka, Illinois: Hill-Fay Associates.

Fay, J.A., D.J. Foster, and R.T. Stanek. 1984. The use of fish and wildlife resources in Tyonek, Alaska. ADFG, Div. Subsistence, Anchorage, Tech. Rep. Ser. 105. 219p.

Finneran, J. J., Schlundt, C. E., Carder, D. A., Clark, J. A., Young, J. A., Gaspin, J. B., and Ridgway, S. H. 2000. "Auditory and behavioral responses of bottlenose dolphins (*Tursiops truncatus*) and a beluga whale (*Delphinapterus leucas*) to impulsive sounds resembling distant signatures of underwater explosions," J. Acoust. Soc. Am. 108, 417 431.

Finneran, J. J., C. E. Schlundt, D. A. Carder, and S. H. Ridgway. 2002. Auditory filter shapes for the bottlenose dolphin (*Tursiops truncatus*) and the white whale (*Delphinapterus leucas*) derived with notched noise. The Journal of the Acoustical Society of America 112:7.

Frankel, A. S. and C. W. Clark 1998. Results of low-frequency playback of M-sequence noise to humpback whales (Megaptera novaeangliae), in Hawai'i. Can. J. Zool. 76(3):521-535.

Fried, S. M., J. J. Laner, and S. C. Weston. 1979. Investigation of white whale (Delphinapterus leucas) predation upon sockeye salmon (Oncorhynchus nerka) smolts in Nushagak Bay and associated rivers: 1979 aerial reconnaissance surveys. Project 11-41-6-340. Alaska Department of Fish and Game, Dillingham, Alaska. 15p.

Frost, K.J., L.F. Lowry, and R.R. Nelson. 1983. Investigations of belukha whales in coastal waters of western and northern Alaska, 1982-1983: marking and tracking of whales in Bristol Bay. U.S. Dept. Commer., NOAA, OCSEAP Final Rep. 43(1986):461-585.

Funk, et al. 2005. (Funk, D.W., R.J. Rodrigues, and M.T. Williams [eds.].) Baseline Studies of Beluga Whale Habitat use in Knik Arm, Upper Cook Inlet, Alaska. Rep. from LGL Alaska Research Associates, Inc., Anchorage, Alaska, for HDR Alaska, Inc., Anchorage, Alaska, and Knik Arm Bridge and Toll Authority, Anchorage, Alaska. 65 p. + appendices.

Geraci, J.R. 1990. Physiologic and Toxic Effects on Cetaceans. p. 167-192. In: Sea Mammals and Oil: Confronting the Risks J.R. Geraci and D.J. St. Aubin, Editors. First ed., Academic Press, Inc., San Diego, California: 239 p.

Hansen, D.J. and J.D. Hubbard. 1999. Distribution of Cook Inlet beluga whales (*Delphinapterus leucas*) in winter. Final Report. OCS Study. MMS 99-0024. U.S. Dep. Int., Minerals Management Service, Alaska OCS Region, Anchorage, AK. 30p.

Hazard, K. 1988. Beluga whale, *Delphinapterus leucas*. *In*: Selected marine mammals of Alaska: species accounts with research and management recommendations. J.W. Lentfer, ed. Mar. Mammal Comm., Washington, D.C.

Herman, L. 1980. Cetacean behavior. New York: John Wiley and Sons.

Hobbs, R.C., D. J. Rugh, and D. P. DeMaster. 2000. Abundance of belugas, Delphinapterus leucas, in Cook Inlet, Alaska, 1994-2000. Mar. Fish. Rev. 62(3):37-45.

Hobbs, R.C., K.E.W. Shelden, D.J. Vos, K.T. Goetz, and D.J. Rugh. 2006. Status review and extinction assessment of Cook Inlet belugas (*Delphinapterus leucas*). AFSC Processed Rep. 2006-16, 74 p. Alaska Fisheries Science Center, National Marine

Fisheries Service, NOAA, 7600 Sand Point Way NE, Seattle WA 98115.

Hobbs, et al. 2008 (Hobbs, R. C., K. E. W. Sheldon, D. J. Rugh, and S. A. Norman.) Status Review and Extinction Risk Assessment of Cook Inlet Belugas. AFSC Processed Report 2008-02, 116 p. Alaska Fisheries Science Center, NOAA, National Marine Fisheries Services, Seattle, Washington.

Huntington, H.P. 2000. Traditional Knowledge of the Ecology of Belugas, *Delphinapterus leucas*, in Cook Inlet, Alaska. Marine Fisheries Review 62: 134-140.

Integrated Concepts and Research Corporation (ICRC) and URS Corporation, 2009. Biological Assessment for the Beluga Whale *Delphinapterus leucas*. For the Port of Anchorage Expansion Project and Associated Dredging. April. Available on the Port of Anchorage Website: http://www.portofanchorage.org/library_p.html.

Integrated Concepts and Research Corporation (ICRC) and URS Corporation, 2010. Biological Assessment for proposed critical habitat of the Beluga Whale *Delphinapterus leucas*. For the Port of Anchorage Expansion Project and Associated Dredging. June.

Karlsen, J.D., A. Bisther, C. Lydersen, T. Haug, KM Kovacs. 2002. Summer vocalizations of adult male white whales *(Delphinapterus leucas)* in Svalbard, Norway. *Polar Biology* 25:808-817.

Katona, S.K., V. Rough, and D.T. Richardson. 1983. A field guide to the whales, porpoises and seals of the Gulf of Maine and eastern Canada. New York: Charles Scribner's Sons.

Kendall, Lindsey Saxon. 2010. Construction impacts on the Cook Inlet beluga whale (Delphinapterus leucas) at the Port of Anchorage Marine Terminal Redevelopment Project. Alaska Pacific University.

Lesage, V., C. Barrette, M. C. S. Kingsley, and B. Sjare. 1999. The Effect of Vessel Noise on the Vocal Behavior of Belugas in the St. Lawrence River Estuary. Marine Mammal Science 15:65-84.

Litzow, M. A., K. M. Bailey, F. G. Prahl, and R. Heintz. 2006. Climate regime shifts and reorganization of fish communities: the essential fatty acid limitation hypothesis. Mar. Ecol. Prog. Ser. 315: 1-11.

Mahoney, B.A. and K.E.W. Shelden. 2000. Harvest history of beluga whale, *Delphinapterus leucas*, in Cook Inlet, Alaska. Marine Fisheries Review, Vol. 62, No. 3.

Markowitz, T.M. and T.L McGuire 2007. Temporal-spatial Distribution, Movements and

Behavior of Beluga Whales Near the Port of Anchorage, Alaska. Final Report from LGL Alaska Research Associates, Inc. Prepared for Integrated Concepts & Research Corporation for the U.S. Department of Transportation Maritime Administration and the Port of Anchorage. 93 pp.

Mate, B.R. and J.T. Harvey (eds). 1987. Acoustical deterrents in marine mammal conflicts with fisheries: a workshop held February 17-18, 1986 at Newport, Oregon. Oregon State University, Corvallis, OR. Publ. No. ORESU-W-86-001. 116 pp.

McGuire, T.L., C.C. Kaplan, M.K. Blees, and M.R. Link. 2008. Photo-identification of beluga whales in Upper Cook Inlet, Alaska. 2007 Annual Report. Report prepared by LGL Alaska Research Associates, Inc., Anchorage, AK, for Chevron, National Fish and Wildlife Foundation, and ConocoPhillips Alaska, Inc. 52 p. + Appendices.

McIwem, J. A. D. 2006. Likely sensitivity of bottlenose dolphins to pile-driving sounds Water and Environment Journal 20:46-54.

Moore, et al. 2000. (Moore, S.E., K.E.W. Shelden, L.L. Litzky, B.A. Mahoney, and D.J. Rugh.) Beluga, *Delphinapterus leucas*, Habitat Associations in Cook Inlet, Alaska. Marine Fisheries Review 62:60-80.

Morrow, J. E. 1980. The freshwater fishes of Alaska. Univ. B.C. Animal Resources Ecology Library. 248 p.

Moulton, M.M. 1997. Early Marine Residence, Growth, and Feeding by Juvenile Salmon in Northern Cook Inlet, Alaska. Alaska Fishery Research Bulletin 4:154-177.

National Marine Fisheries Service (NMFS) 2008. Final Conservation Plan for the Cook Inlet Beluga Whale (*Delphinapterus leucas*). National Marine Fisheries Service, Juneau, Alaska.

National Marine Fisheries Service (NMFS) 2010. Biological Opinion on the Port of Anchorage expansion on the Cook Inlet Belguga Whale (*Delphinapterus leucas*).

Payne, S.A., B.A. Johnson, and R.S. Otto. 1999. Proximate composition of some north-eastern Pacific forage fish species. Fish Oceanogr. 8:3, 159-177.

Pentec 2005a. Marine Fish and Benthos Studies in Knik Arm, Anchorage, Alaska. Prepared for Knik Arm Bridge and Toll Authority and HDR Alaska, Inc. Report 12214-10/12214-12. Prepared by Pentec Environmental, Edmonds, Washington.

Prevel, Ramos, et al. 2006. (Prevel Ramos, A.P., T.M. Markowitz, D.W. Funk, and M.R. Link.). Monitoring Beluga Whales at the Port of Anchorage: Pre-expansion Observations, August-November 2005. Report from LGL Alaska Research Associates, Inc., Anchorage, Alaska, for Integrated Concepts & Research

Corporation, the Port of Anchorage, Alaska, and the waterfront Department of Transportation Maritime Administration.

Richardson, W.J., CR Greene, CI Makne, and DH Thomson. 1995. Marine Mammals and Noise: Academic Press An Elsevier Science Imprint.

Rugh, et al. 2000. (Rugh, D.J., K.E.W. Shelden, and B.A. Mahoney.) Distribution of Belugas, *Delphinapterus le*ucas, in Cook Inlet, Alaska, During June/July 1993-2000. Marine Fisheries Review 62: 6-21.

Rugh, et al. 2004a. (Rugh, D.J., B.A. Mahoney, and B.K. Smith.) Aerial Surveys of Beluga Whales in Cook Inlet, Alaska, Between June 2001 and June 2002. U.S. Department of Commerce. NOAA Technical Memorandum NMFS-AFSC-145.

Rugh, et al. 2005a. (Rugh, D.J., K.E.W. Shelden, C.L. Sims, B.A. Mahoney, B.K. Smith, L.K. (Litzky) Hoberecht, and R.C. Hobbs.) Aerial Surveys of Belugas in Cook Inlet, Alaska, June 2001, 2002, 2003, and 2004. NOAA Technical Memorandum NMFS-AFSC-149. 71pp.

Scheifele, P.M. 1987. Hearing and acoustical behavior data from captive Beluga Whales at Mystic Marinelife Aquarium. Unpublished. Aquarium report.

Scientific Fishery Systems, Inc. 2009. 2008 underwater noise survey during pile driving, Port of Anchorage Marine Terminal Redevelopment Project, in support of Alaska Native Technologies, LLC/ Prepared for U.S. Dept. Transportation Maritime Administration, Port of Anchorage, and Integrated Concepts & Research Corp.

Shelden, K.E.W., D.J. Rugh, B.A. Mahoney, and M.E. Dahlheim. 2003. Killer whale predation on beluga whale in Cook Inlet, Alaska: Implications for a depleted population. Marine Mammal Science: 19(3):529–544.

Schlundt, C.E., Finneran, J.J., Carder, D.A., and Ridgway, S.H. 2000. Temporary threshold shifts in masked hearing thresholds (MTTS) of bottlenose dolphins and white whales after exposure to intense tones. Journal of the Acoustical Society of America, 107, 3496-3508.

Small, R.J., M. Castellote, M.O. Lammers, J. Jenniges, A. Rosinski, S. Atkinson, C. Garner, S. Moore, W.L. Au. 2010. Seasonal distribution of Cook Inlet beluga whales based on passive acoustic monitoring. Presented at Cook Inlet Beluga Whale Science Conference, Anchorage.

Southall, B.L., A.E. Bowles, W.T. Ellison, J.J. Finneran, R.L. Gentry, C.R. Greene Jr., D. Kastak, D.R. Ketten, J.H. Miller, P.E. Nachtigall, W.J. Richardson, J.A. Thomas, and P.L. Tyack. 2007. Marine mammal noise exposure criteria: initial scientific recommendations. Aquatic Mammals 33(4): 411-521.

Speckman, S.G. and J.F. Piatt. 2000. Historic and Current Use of Lower Cook Inlet, Alaska, by Belugas, *Delphinapterus leucas*. Mar. Fish. Rev. 63(3):22-26.

United States Corps of Engineers. 2003. Anchorage Harobr, Alaska. 2003 project maps and index sheets. U.S. Army Corps of Engineers, Alaska District.

United States Army Corps of Engineers (Corps) 2008. Environmental Assessment and Finding of No Significant Impact: Anchorage Harbor Dredging and Disposal, Anchorage, Alaska. August.

URS Corporation (URS) 2007. Port of Anchorage Marine Terminal Development Project Underwater Noise Survey Test Pile Driving Program, Anchorage, Alaska. Report prepared for Integrated Concepts & Research Corporation, Anchorage, Alaska.

URS Corporation (URS), 2009. Acoustic Monitoring 2009 Construction Activities Associated with the Port of Anchorage Marine Terminal Redevelopment Project. Prepared for U.S. Department of Transportation Maritime Administration, the Port of Anchorage, and Integrated Concepts & Research Corporation. October.

Vos, D.J. and K.E.W. Shelden. 2005. Unusual mortality in the depleted Cook Inlet beluga population. Northwest. Nat. 86(2):59-65.

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