ENDANGERED SPECIES ACT: SECTION 7 CONSULTATION
BIOLOGICAL OPINION

Action Agency:	U.S. Department of Transportation, Maritime Administration, U.S. Army Engineer District, Alaska, and National Marine Fisheries Service
Activity:	Marine Terminal Redevelopment Project at the Port of Anchorage, Alaska
Consulting Agency:	National Marine Fisheries Service, Alaska Region
Date Issued:	July 13, 2009
Approved By:	

The U.S. Department of Transportation, 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 Marine Terminal Redevelopment Project at the Port of Anchorage, Alaska by letters dated March 24, 2009 (NMFS). This opinion considers the effects of this action on the endangered Cook Inlet beluga whale. In formulating this Biological Opinion, NOAA Fisheries used information presented in the March 2009 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.

Consultation History

MARAD submitted an application to NMFS for authorization to take Cook Inlet beluga whales and other marine mammals under the Marine Mammal Protection Act by letter dated November 20, 2008. On December 19, 2008, MARAD wrote NMFS to request formal consultation under section 7 (s7) of the ESA. MARAD submitted a draft Biological Assessment (BA) in support of its request in March 2009. NMFS requested additional information from MARAD, which was provided in a March 2009 revised BA. MARAD subsequently wrote a letter of May 8, 2009 presenting the revised BA and requesting an expedited s7 review. On March 24, 2009 NOAA PCD wrote to the Alaska Region, NMFS requesting formal consultation on its action of authorization for this construction under the MMPA. The U.S. Army Engineer District, Alaska, (Corps) has federal responsibility for dredging associated with this project. There are, then, three

(3) federal action agencies associated with this consultation. MARAD is recognized as the lead action agency.

The COE has requested its dredging operations be separately assessed by NMFS so that it might initiate project dredging in May 2009 to remove shoaling at the Port of Anchorage that is currently interfering with docking of vessels. Because the BA found this dredging activity was not likely to adversely affect Cook Inlet beluga whales, NMFS agreed to this request and by letter dated May 12, 2009, concurred with that determination. Consultation under the ESA is now concluded for this dredging action but will be described in this opinion as it concerns a description of the proposed work and in the effects analysis.

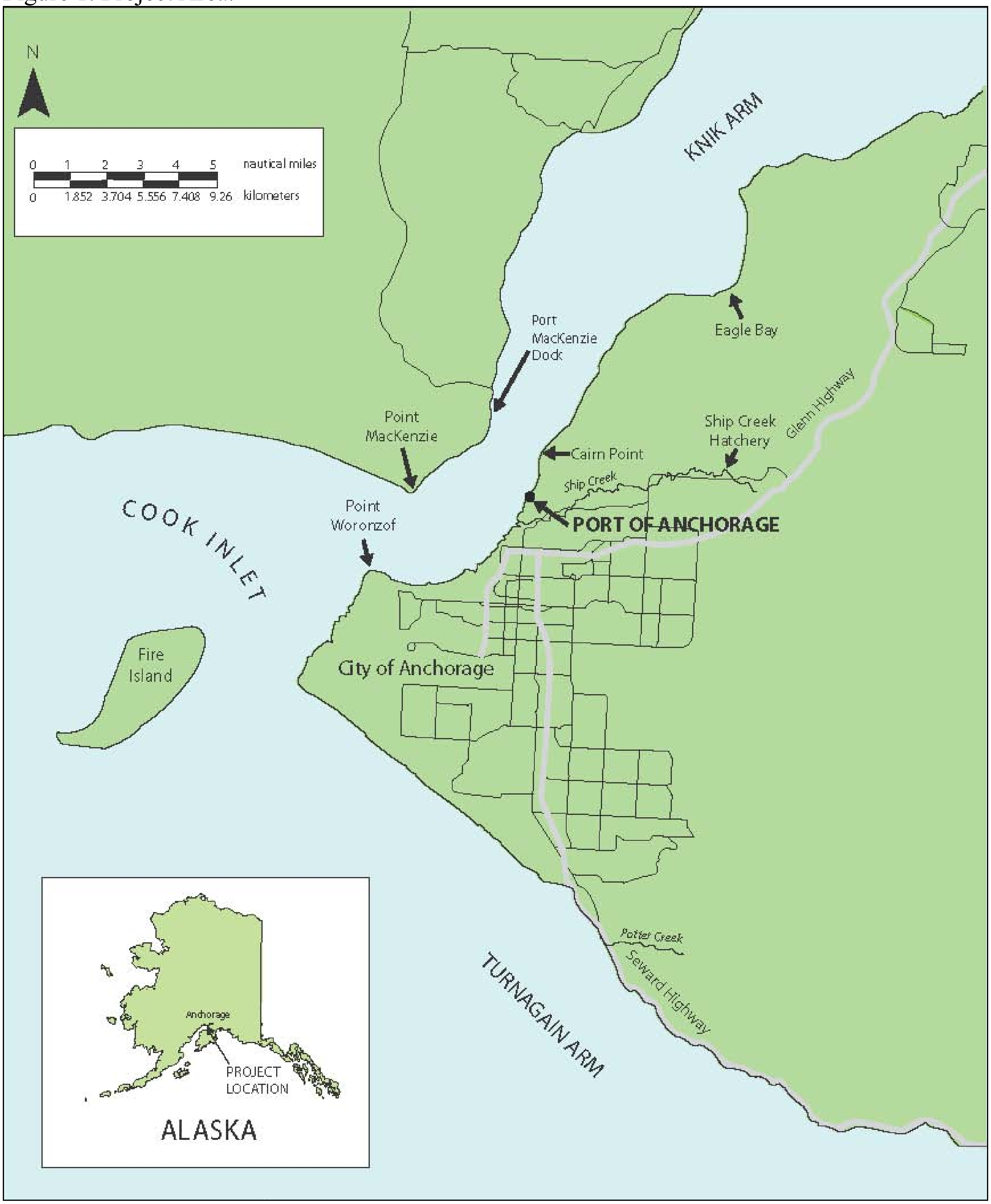
Term of this Opinion

This opinion will be valid upon issuance and remain in force until re-initiation may become necessary. Consultation will be re-initiated if there are significant changes in the type of activities occurring, if new information indicates these actions are impacting the Cook Inlet beluga whale or other listed species/critical habitats to a degree or in a manner not previously considered, or if new species or critical habitats become listed under the Act.

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). 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.



I. DESCRIPTION of the PROPOSED ACTION

This opinion 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 continued existence of the Cook Inlet beluga whale, as well as to provide measures to conserve the species and mitigate impact. The U.S. Department of Transportation, Maritime Administration is the lead Federal agency for this project. The U.S. Army Engineer District, Alaska is a cooperating action agency with responsibilities for issuance of permits under the Rivers and Harbors Act and Clean Water Act, as well as dredging activities under Congressional authorization.

This opinion will also address authorization by NMFS of the incidental and unintentional taking of Cook Inlet beluga whales due to construction activities at the Port of Anchorage. Section 101 (a)(5) of the Marine Mammal Protection Act (MMPA), directs the Secretary of Commerce to allow, upon request by U.S. citizens engaged in a specific activity (other than commercial fishing) in a specified geographical region, the incidental but not intentional taking of small numbers of marine mammals if certain findings are made. Such authorization may be accomplished through regulations and issuance of letters of authorization under those regulations, or through issuance of an incidental harassment authorization. These authorizations are often requested for activities which produce underwater noise capable of harassing or harming marine mammals. Harassment is a form of taking otherwise prohibited by the MMPA and ESA. Except with respect to certain activities not pertinent here, the MMPA defines "harassment" as:

> any act of pursuit, torment, or annoyance which (I) has the potential to injure a marine mammal or marine mammal stock in the wild [Level A harassment]; or (ii) 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 [Level B harassment].

Authorization for incidental takings may be granted for up to 5 years if NMFS finds that the taking will have a negligible impact on the species or stock(s), will not have an unmitigable adverse impact on the availability of the species or stock(s) for certain subsistence uses, and if the permissible methods of taking and requirements pertaining to the mitigation, monitoring and reporting of such taking are set forth. NMFS has defined "negligible impact" in 50 CFR 216.103 as: an impact resulting from the specified activity that cannot be reasonably expected to, and is not reasonably likely to, adversely affect the species or stock through effects on annual rates of recruitment or survival.

On November 20, 2008, NMFS received an application from the POA/MARAD for regulations and subsequent Letters of Authorization (LOAs) to take, by Level B harassment only, marine mammals incidental to the Marine Terminal Redevelopment Project (MTRP). The POA/MARAD have been in discussions with NMFS Office of Protected Resources Permits Division and Alaska Regional Office (AKR), Anchorage, since inception of the MTRP (2003) to ensure compliance with the MMPA and to reduce impact to marine mammals and their habitat. In 2008, NMFS issued the POA/MARAD a one-year IHA authorizing incidental take of marine mammals from pile driving (73 FR 41318, July 18, 2008). The IHA, which expires on July 15, 2009, authorizes the take, by Level B harassment only, of 34 beluga whales, 20 harbor seals, 20 harbor porpoise, and 5 killer whales. To date, marine mammal observations (submitted by trained, NMFS approved observers on-site at the POA and a second independent scientific marine mammal monitoring team) indicate that the effects analysis in NMFS's 2008 Environmental Assessment (EA) on the Issuance of an Incidental Harassment Authorization and Subsequent Rulemaking for Take of Small Numbers of Marine Mammals Incidental to the Port of Anchorage Terminal Redevelopment Project, Anchorage, Alaska is appropriate and justifiable as pile driving noise does not appear to impact beluga whale surface behavior (see Impacts to Marine Mammals).

The actions, consequence, and environmental effects of these MMPA authorizations are the same as those described here for the construction actions (i.e., the activities for which an MMPA authorization would be issued). The following section presents an overview of the major construction features associated with the project.

Overview

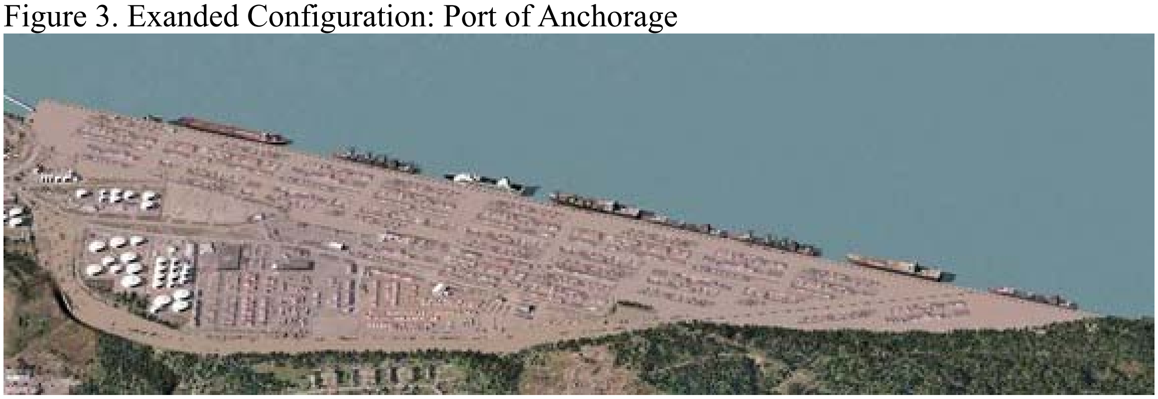
The Marine Terminal Redevelopment (MTR, also referred to as the Port of Anchorage Intermodal Expansion Project or simply port expansion project) is being conducted through a partnership between the Port of Anchorage and the U.S. Department of Transportation Maritime Administration (Maritime Administration). 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 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 MTRP 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 usuable 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 2. Port in 2005; Prior to Expansion Project Activities

Figure 3. Exanded Configuration: Port of Anchorage



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
- Demolition of the existing docks

Dredging

a) 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).

b) 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.

c) 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.

d) Dredging Methodology: 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.

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.

Pile Driving

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 liquifies 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 the 2008 IHA, NMFS established a threshold of 120dB for 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.

Demolition of Existing Dock

Demolition of the existing, active dock is currently scheduled in two phases to begin in 2010 and could continue intermittently through 2013, depending on the demolition approach and sequencing selected. Phase 1 of dock demolition, scheduled for 2010/2011, 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, <u>in-water blasting has been eliminated from further consideration</u>.

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 MTRP, therefore, all three methods are proposed with appropriate, respective mitigation.

a) 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 MTRP 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 MTRP. 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.

b) 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.

c) 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.

Interrelated and interdependent activities

Interrelated actions are those that are part of a larger action and depend on the larger action for their justification. Interdependent actions are those that have no independent utility apart from the action under consideration. 50 CFR 402.02. NMFS has not identified any interrelated or interdependent actions.

II. STATUS OF THE SPECIES (RANGEWIDE)

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. This opinion will consider the potential effects of the above described actions on this species. Cook Inlet beluga whales are also designated as depleted and strategic under the Marine Mammal Protection Act.

Cook Inlet Beluga Whale Biology and Habitat Use

The beluga whale is a small, toothed whale in the family *Monodontidae*, a family it shares with only the narwhal. Belugas are also known as "white whales" because of the white coloration of the adults. The beluga whale is a northern hemisphere species, ranging primarily over the Arctic Ocean and some adjoining seas, where it inhabits fjords, estuaries, and shallow water in Arctic and subarctic oceans. Five distinct stocks of beluga whales are currently recognized in Alaska: Beaufort Sea, eastern Chukchi Sea, eastern Bering Sea, Bristol Bay, and Cook Inlet. The Cook

Inlet population is numerically the smallest of these, and is the only one of the five Alaskan stocks occurring south of the Alaska Peninsula in waters of the Gulf of Alaska.

A detailed description of the biology of the Cook Inlet beluga whale may be found in the Conservation Plan (NMFS 2008), and the Proposed Listing Rule (72 FR 19854; April 20, 2007). 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.

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.

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. Their vision is reported to also be well developed; they appear to have acute vision both in and out of water and, as their retinas contain both rod and cone cells, are believed to see in color (Herman 1980).

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).

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.

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).

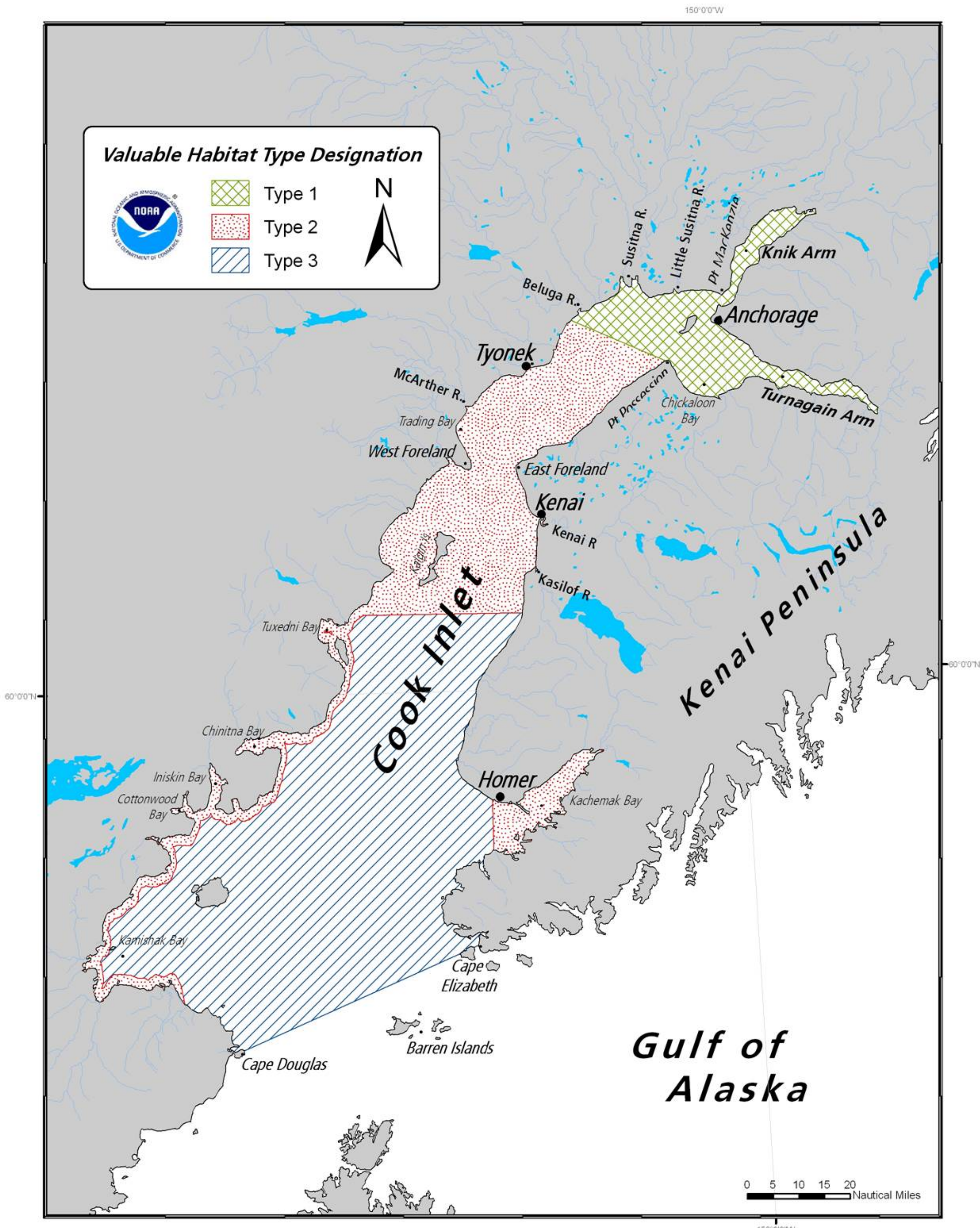
Habitat Types and Value

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.

a) 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 4 . Valuable habitat areas (Types 1, 2, 3) identified for Cook Inlet beluga whales.


Valuable Habitat Type Designation
Type 1
Type 2
Type 3
N
Susitna R.
Little Susitna R.
Pt MacKenzie
Knik Arm
Beluga R.
Anchorage
Tyonek
McArther R.
Trading Bay
Pt Possession
Chickaloon Bay
Turnagain Arm
West Foreland
East Foreland
Kenai
Kenai R
Kalgin Is
Kasilof R
Kenai Peninsula
Tuxedni Bay
Cook Inlet
Chinitna Bay
Iniskin Bay
Cottonwood Bay
Homer
Kachemak Bay
Kamishak Bay
Cape Elizabeth
Barren Islands
Cape Douglas
Gulf of Alaska
0 5 10 15 20 Nautical Miles
150°0'0"W
60°0'0"N

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.

b) 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 area 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.

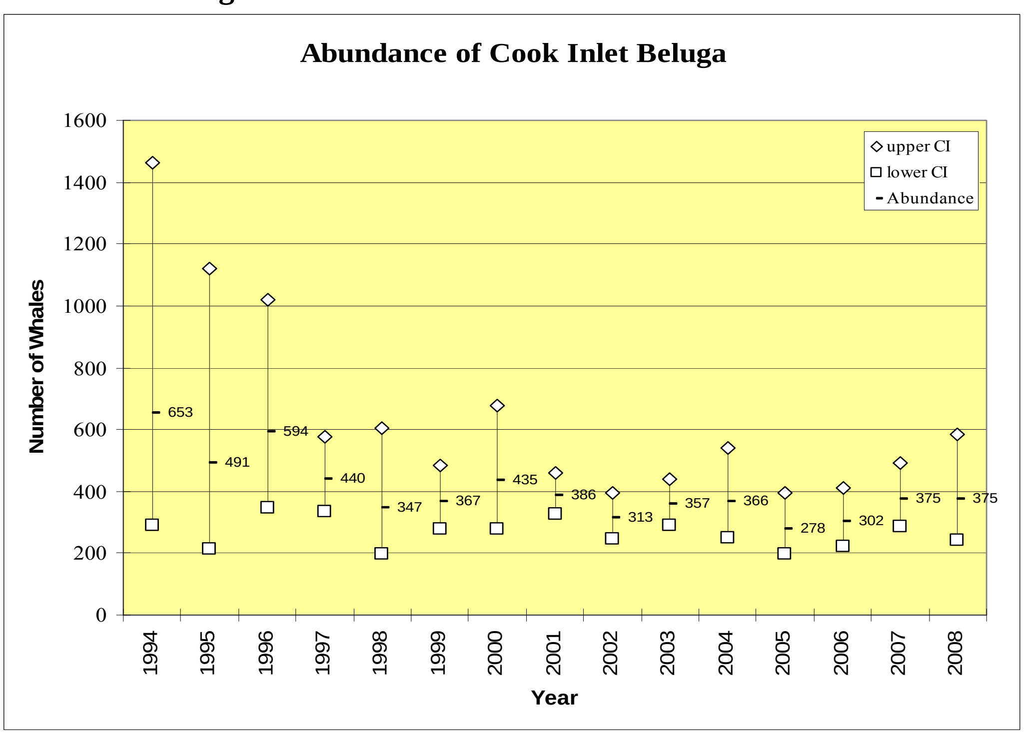
c) Type 3 Habitat: Type 3 habitat encompasses the remaining portions of Cook Inlet where belugas are infrequently observed, and areas which are not identified as Type 1 or 2 (e.g., not including the areas along the nearshore western portion of the Inlet). Type 3 habitat is south of 60.2500 north latitude 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.

Abundance and Trends

The Cook Inlet beluga stock has probably always numbered fewer than several thousand animals, but has declined significantly from its historical abundance. It is difficult to accurately determine the magnitude of decline, because there is no available information on the abundance of beluga whales that existed in Cook Inlet prior to development of the southcentral Alaska sub-Region, nor prior to modern subsistence whaling by Alaska Natives.

Figure 5. Cook Inlet beluga abundance estimates.



Using a correction factor of 2.7 developed for estimating submerged whales under similar conditions in Bristol Bay (Frost et al. 1985), Calkins (1989) provides an overall abundance estimate of 1,293 whales. Calkins' estimate, which utilized the most complete survey of the Inlet prior to 1994 and incorporated a correction factor for animals missed during the survey, provides the best available data for estimating historical abundance of beluga whales in the Inlet. For management purposes, NMFS currently considers 1,300 beluga whales as a reasonable estimate of historical abundance. NMFS began comprehensive, systematic aerial surveys of beluga whales in Cook Inlet in 1993. Unlike previous efforts, these surveys included the upper, middle, and lower Inlet. These surveys documented a decline in abundance of nearly 50 percent between 1994 (653 whales) and 1998 (347 whales) (Hobbs et al. 2000b). Figure 5 depicts abundance estimates from annual abundance surveys conducted each June since 1994 (Hobbs et al. 2000b; Rugh et al. 2005; NMFS unpubl. data).

NMFS estimates the carrying capacity for this stock/DPS to be 1,300 belugas, and the maximum theoretical net productivity rate between two and six percent. Even though subsistence harvests from this stock have been restricted to one or two whales annually since 1999, aerial surveys continue to document an annual decline of 2.75 percent (1999 to 2007). Differences in survey design and analytical techniques prior to 1994 rule out a precise statistical assessment of trends using the first available population estimate, however, simply comparing the estimate of 1,293 belugas in 1979 to 375 belugas in 2007 indicates a 71 percent decline in 29 years, but with unspecified confidence. NMFS has committed to conducting systematic annual abundance surveys which should reduce uncertainties in population status and growth over time.

Observations within the Action Area

The lower reaches of Knik Arm and the action area are regularly used by Cook Inlet beluga's. 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).

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).

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.

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.

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.

Population Viability Analysis and Extinction Risk Assessment
The National Marine Mammal Laboratory has published the 2008 Status Review and Extinction Risk Assessment of Cook Inlet Beluga Whales (*Delphinapterus leucas*). That document included an update of a November 2006 Status Review and responded to issues raised by a panel of independent experts regarding the earlier Status Review. The conclusions of the 2008 Review were:

* The contraction of the range of this population northward into the upper Inlet makes it far more vulnerable to catastrophic events which have the potential to kill a significant fraction of the population
* The population is not growing at 2% to 6% per year as had been anticipated since the cessation of unregulated hunting.
* The population is discrete and unique with respect to the species, and if it should fail to survive, it is highly unlikely that Cook Inlet would be repopulated with belugas. This would result in a permanent loss of a significant portion of their range.
* The importance of seasonal anadromous fish runs in Cook Inlet to belugas is evident. The bulk of their annual nutrition is acquired during the summer months.
* Belugas in Cook Inlet are unique in Alaska given their summer habitat is in close proximity to the largest urban area in the state.
* While the impact of disease and parasitism on this population has not been quantified, this population is at greater risk because of its small size and limited range such that a novel disease would spread easily through this population.

* The PVA shows a 26% probability of extinction in 100 years (for the model assuming one predation mortality per year and a 5% annual probability of an unusual mortality event killing 20% of the population). It is likely that the Cook Inlet beluga population will continue to decline or go extinct over the next 300 years unless factors determining its growth and survival are altered in its favor.

The Review also reaffirmed NMFS's earlier position that the Cook Inlet stock of beluga whales is discrete and significant in terms of the ESA and constitutes a species under the definitions of that Act. The 2008 Review included a Population Viability Analysis (PVA). The PVA model was the most-detailed of any such models for Cook Inlet belugas, being age and sex based and focusing on the behavior of a declining population at sizes less than 500 whales. Small population effects, demographic stochasticity, Allee effects, predation mortality, and unusual mortality events were modeled explicitly. The PVA employed twenty (20) sub-models with various assumptions and differing levels of predation, unusual mortality events, Allee effects, habitat loss, counting/survey errors, and other factors totaling eleven in all. For each sub-model, 100,000 trials were run to provide a statistical distribution of the stochastic and deterministic variables of the model in order to allow for analysis. The results of the PVA were then used to input the Extinction Risk Analysis (ERA) to estimate the probabilities for the stock to become extirpated within certain time frames. The ERA found that, for the sub-model judged to be the best approximation of the current population, the probability for extinction was 26% within 100 years.

An important outcome of the ERA was that the extinction probabilities increased dramatically when predation was set above an assumed one (1) mortality per year. We do not have adequate data to accurately evaluate the level of removals from this stock due to killer whale predation, but believe it could very easily exceed this threshold. Additionally, any factors which may result in any additional mortality would have the same impact on these extinction risk figures. This finding has particular significance in assessing the cumulative risks to the Cook Inlet belugas. In the following section we discuss other factors (stressors) known or believed to be impacting this population. The individual and cumulative contribution of these stressors must be carefully considered in assessing the consequences of the proposed action.

III. ENVIRONMENTAL BASELINE

By regulation, the environmental baseline for opinions 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). The occurrence, numbers, and habitat use of the Cook Inlet beluga whale have been described above. 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. This summary of the environmental baseline complements the information provided in the *Status of The Species* section of this opinion, and provides the background necessary to understand information presented in the *Effects of the Action* and *Cumulative Effects* sections. We then evaluate these consequences in combination with the baseline to determine the likelihood of jeopardy.

Natural Factors

A) Stranding: Beluga whale strandings in upper Cook Inlet are not uncommon, with a majority occurring in Turnagain Arm. NMFS has reports of over 700 whales stranding in upper Cook Inlet since 1988. Mass strandings (involving two or more whales) primarily occurred in Turnagain Arm and often coincided with extreme tidal fluctuations ("spring tides") or killer whale sighting reports (Shelden et al. 2003). In 2003, an unusually high number of beluga live strandings (five separate events involving between 2 and 46+ whales) and mortalities (n=20) occurred in Cook Inlet (Vos and Shelden 2005). These strandings involved both adult and juvenile beluga whales which appeared to be healthy, robust animals. The NMFS' 2006 status review (Hobbs et al. 2006) recognized that stranding was a constant threat to the recovery of Cook Inlet belugas. NMFS determined this declining population could not easily recover from multiple mortalities resulting from a mass stranding event. For instance, in 2003 there were five separate stranding events involving potentially 115 individual belugas (i.e., assuming no beluga stranded more than once); if all had died as a result of these strandings, one third of the population would have been lost in a single year. In 2003 over 45 beluga whales were stranded at the far end of Turnagain Arm and were out of the water for roughly 10 hours waiting for the tide to return. From this one event, five belugas were thought to have died as a direct consequence based upon beach cast carcasses found in the following days. Prolonged stranding events lasting more than a few hours may result in significant mortalities. The annual abundance estimates do not indicate a high probability that this population is recovering, and NMFS now believes strandings may represent a significant threat to the conservation and recovery of these whales.

b) Predation: The Cook Inlet beluga whale stock is preyed upon by killer whales, their only known natural predator. The number of killer whales reported in the upper Inlet appears to be small. This may be a single pod with five or six individuals that has extended its feeding territory into Cook Inlet. Given the small population size of the Cook Inlet beluga whales, predation may have a significant effect on beluga abundance. On average one Cook Inlet beluga whale is killed per year by killer whales (Shelden et al. 2003). The effects of killer whale predation were also addressed in status reviews conducted by NMFS in 2006 and 2008; the models demonstrated that killer whale predation on an annual basis could significantly impact recovery. In addition to directly reducing the beluga population, the presence of killer whales in Cook Inlet may also increase stranding. As such, NMFS considers killer whale predation to be a potentially significant threat to the conservation and recovery of these whales.

c) Environmental Change: There is now widespread consensus within the scientific community that atmospheric temperatures on earth are increasing (warming) and that this will continue for at least the next several decades. There is also consensus within the scientific community that this warming trend will alter current weather patterns. Cook Inlet is a very dynamic environment which experiences continual change in its physical composition; there are extreme tidal changes, strong currents, and tremendous amounts of silt being added from glacial scouring. For example, an experienced and knowledgeable Alaska native beluga hunter observed that the Susitna River (an area frequented by belugas, especially during fish runs) has filled in considerably over the past 40-50 years (Pers. Comm. P. Blatchford 1999 via B. Smith, NMFS). He told of one persistent channel in the river that was more than 40 feet deep but that is now filled in with sediment. Since belugas are still seen in the area today, they may be able to adapt to physical changes in their habitats.

The climate in Cook Inlet is driven by the Alaska Coastal Current (ACC; a low salinity river-like body of water flowing through the Pacific Ocean and along the coast of Alaska with a branch flowing into Cook Inlet) and the Pacific Decadal Oscillation (PDO). PDO is similar to El Nino except it lasts much longer (20-30 years in the 20th century) and switches between a warm phase and a cool phase. Phase changes of the PDO have been correlated with changes in marine ecosystems of the northeast Pacific; warm phases have been accompanied by increased biological productivity in coastal waters of Alaska and decreased productivity off the west coast of Canada and the US, whereas cold phases have been associated with the opposite pattern.

Prior to 2004 temperatures in the Gulf of Alaska were relatively stable, but in mid 2004 temperatures warmed and stayed warm until late 2006. Sampling of oceanographic conditions (via GAK-1) just south of Seward, Alaska has revealed anomalously cold conditions in the Gulf of Alaska beginning winter of 2006-2007; "deep (>150m depth) temperatures are the coldest observed since the early 1970s" (Weingartner 2007). Deep water temperatures are anticipated to be even colder in winter 2007-2008 due to deep shelf waters remaining cold throughout the 2007 summer, and Gulf of Alaska temperatures in spring 2008 are predicted to be even colder than in spring 2007 (Weingartner 2007).

The change in water temperature may in turn affect zooplankton biomass and composition. Plankton are mostly influenced by changes in temperature, which may affect their metabolic and developmental rates, and possibly survival rates (Batten and Mackas 2007). Data collected by Batten and Mackas (2007) demonstrated that mesozooplankton (planktonic animals in the size range 0.2-20 mm) biomass was greater in warm conditions, and that zooplankton community composition varied between warm and cool conditions, thus potentially altering their quality as a prey resource (Batten and Mackas 2007). In Cook Inlet, mesozooplankton biomass has increased each year from 2004 to 2006, however sampling from late 2006 to early 2007 suggests biomass values are decreasing; a change most certainly driven by changes in climate (Batten 2007). Therefore, temperature changes effect changes in zooplankton, which in turn may influence changes in fish composition, and hence alter the quality and types of fish available for belugas. While El Nino events have the potential to affect sea surface temperatures, the effects of a 1998 El Nino warming event on lower Cook Inlet were lessened by upwelling and tidal mixing at the entrance to Cook Inlet (Piatt et al. 1999). It is likely that the physical structure of the Inlet and its dominance by freshwater input acts to buffer these waters from periodic and short-term El Nino events.

Beluga use of the Inlet, and particularly feeding habitat, has been correlated to the presence of tidal flats and related bathymetry. Their preference for shallow waters found in Knik Arm, Turnagain Arm, and the Susitna River delta undoubtedly relates to feeding strategy, as has been reported for belugas in Bristol Bay (Fried et al. 1979). Frost et al. (1983) theorized beluga whales' feeding efficiencies improve in relatively shallow channels where fish are confined or concentrated. There is evidence these areas are being lost through the deposition of glacial materials. The senescence of these habitats will likely reduce the capacity of the upper Inlet to provide for the needs of this population.

At this time however, the data are insufficient to assess effects (if any exist) of environmental change on Cook Inlet beluga whale distribution, abundance, or recovery.

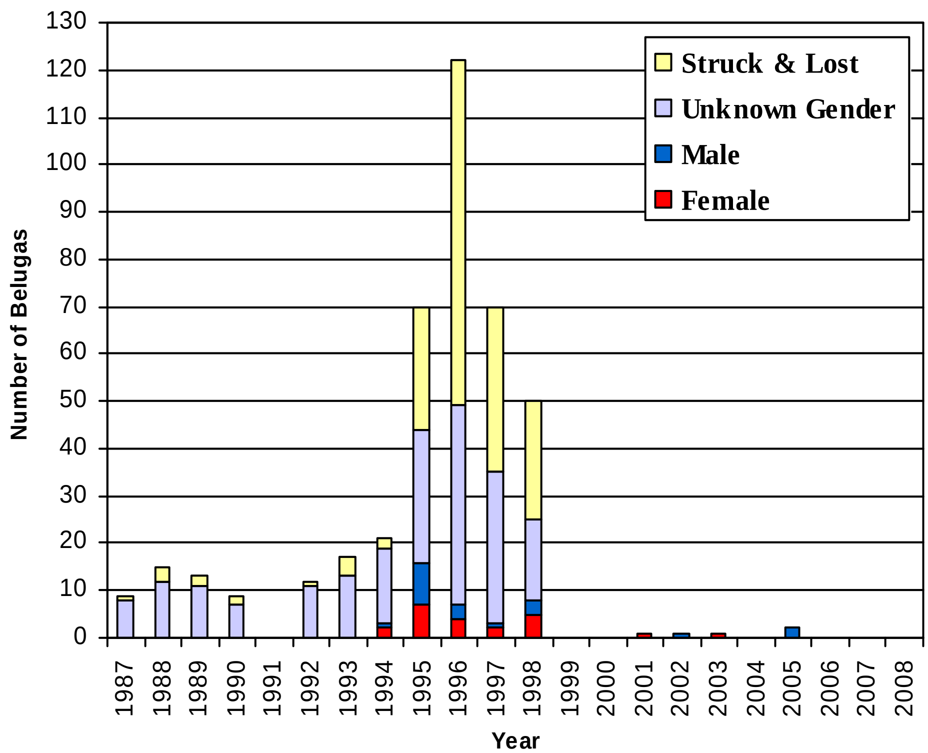
Human Induced Factors

The upper Cook Inlet region is the major population center of Alaska, with the 2001 population of the Anchorage Borough at 264,937, the Matanuska-Susitna Borough at 62,426, and the Kenai Peninsula Borough at 50,556 (U.S. Census Bureau). Such large numbers of people in a relatively small area present added concerns to the natural environment and to Cook Inlet belugas.

a) Subsistence Harvest: The Cook Inlet beluga whale is hunted by Alaska Natives for subsistence purposes and for traditional handicrafts. The MMPA provides an exemption from the prohibitions of the Act which allows for the harvest of marine mammals by Alaska Natives for these purposes. Alaska Natives have legally harvested Cook Inlet beluga whales prior to and after passage of the MMPA in 1972. The effect of past harvest practices on the Cook Inlet beluga whale population is significant. While a harvest occurred at unknown levels for decades, NMFS believes the subsistence harvest levels increased substantially in the 1980s and 1990s. Reported subsistence harvests between 1994 and 1998 can account for the estimated decline of the stock during that interval. The observed decline during that period and the reported and estimated harvest rates (including estimates of whales which were struck and lost, and assumed to have perished) indicate these harvest levels were unsustainable.

Figure 6 summarizes subsistence harvest data from 1987 to 2007 (Angliss et al. 2001, NMFS unpubl. data). A study conducted by ADFG, in cooperation with the Alaska Beluga Whale Committee (ABWC) and the Indigenous People's Council for Marine Mammals, estimated the subsistence take of belugas in Cook Inlet in 1993 at 17 whales. However, in consultation with Native elders from the Cook Inlet region, the Cook Inlet Marine Mammal Council (CIMMC) estimated the annual number of belugas taken by subsistence hunters during this time to be greater (DeMaster 1995). There was no systematic Cook Inlet beluga harvest survey in 1994. Instead, harvest data were compiled at the November 1994 ABWC meeting, including two belugas taken by hunters from Kotzebue Sound. The most thorough Cook Inlet beluga subsistence harvest surveys were completed by CIMMC during 1995 and 1996. While some local hunters believed that the 1996 estimate of struck and lost is positively biased, the CIMMC's 1995 to 1996 take estimates are considered reliable (Angliss et al. 2001). Given that there was no survey during 1997 or 1998, NMFS estimated the subsistence harvest from hunter reports. The known annual subsistence harvest by Alaska Natives during 1995-1998 averaged 77 beluga whales.

Figure 6: Summary of known Cook Inlet beluga whale subsistence harvest from 1987-2007 (NOAA 2007).



The harvest, which was as high as 20 percent of the population in 1996, was sufficiently high to account for the 14 percent annual rate of decline in the population during the period from 1994 through 1998 (Hobbs et al. 2000). In 1999 there was no harvest as a result of a voluntary moratorium by the hunters that spring and the permanent moratorium in 2000. During 2000-2003 and 2005-2006 NMFS entered into co-management agreements for the Cook Inlet beluga subsistence harvest. Between 2000 and 2007, subsistence harvests have been 0, 1, 1, 1, 0, 2, 0, and 0 whales, respectively.

Sections 101(b) and 103(d) of the MMPA require that regulations prescribed to limit Alaska Native subsistence harvest be made only when the stock in question is designated as depleted pursuant to the MMPA and following an Agency administrative hearing on the record. NMFS had an administrative hearing in December 2000 where interim harvest regulations for 2001-2004 were developed and another administrative hearing in

August 2004 to prepare the long term harvest plan. NMFS published the Cook Inlet Beluga Whale Subsistence Harvest Draft Supplemental Environmental Impact Statement in December 2007 that provided four alternatives on the long term harvest for Cook Inlet belugas. The Cook Inlet Beluga Whale Subsistence Harvest Final Supplemental Environmental Impact Statement, with a set harvest plan, was published in June 2008 and, long-term harvest regulations were implemented.

b) Poaching and Illegal Harassment: Due to their distribution within the most-densely populated region of Alaska and their approachable nature, the potential for poaching belugas in Cook Inlet still exists. Although NOAA maintains an enforcement presence in upper Cook Inlet, the area they have to cover is extensive. While poaching is a possible threat, no poaching incidents have been confirmed to date. NOAA Enforcement has investigated several incidences of reported harassment of Cook Inlet belugas, but to date there have been no convictions. The potential, however, for both poaching and illegal harassment exists.

c) Personal Use, Subsistence and Recreational Fishing: Personal use gill net fisheries occur in Cook Inlet. Fishing for eulachon (hooligan) is popular in Turnagain Arm, with no bag or possession limits. The two most significant areas where eulachon are harvested in personal use fisheries are the Twentymile River (and shore areas of Turnagain Arm near Twentymile River) and Kenai River. Other areas where eulachon are harvested include the Big and Little Susitna River and their tributaries, the Placer River, and shoreline areas of Turnagain Arm and Cook Inlet north of the Ninilchik River. Annual harvests have ranged from 2.2 to 5 tons over the past decade. The personal use harvest of eulachon is possibly under-reported as some participants may confuse their harvests as being subsistence and not personal use.

Recreational fishing is a very popular sport in Alaska, as evidenced by the intensive fishing during salmon runs and the high number of charter fishing operations. In upper Cook Inlet there are numerous recreational fishing areas targeting primarily salmon, including the hundreds of drainages of the Susitna River; the Little Susitna River; the west Cook Inlet streams; and areas around Anchorage such as Ship Creek. Recreational fishing for salmon in Ship Creek is the most popular stream fishery in the Anchorage area. In lower Cook Inlet, recreational fishing for groundfish such as halibut, rockfish and lingcod are also popular. There are even recreational fishers digging for littleneck clams, butter clams, and razor clams. NMFS is unaware of any beluga whales injured or killed in the Cook Inlet due to personal use, subsistence, or recreational fisheries. However, the most likely impacts from these fisheries include the operation of small watercraft in stream mouths and shallow waters, ship strikes, displacement from important feeding areas, harassment, and prey competition.

d) Commercial Fishing: Several commercial fisheries occur in Cook Inlet waters and have varying likelihoods of interacting with beluga whales (either directly or via competition for fish) due to differences in gear type, species fished, timing, and location of the fisheries. Interactions refer to entanglements, injuries, or mortalities occurring incidental to fishing operations. Given that beluga whales concentrate in upper Cook

Inlet during summer (Type 1 and 2 habitats) (Rugh et al. 2000), fisheries occurring in those waters during that time could have a higher likelihood of interacting with beluga whales.

i) Incidental Take

The term incidental take in regards to commercial fishing refers to the catch or entanglement of animals that were not the intended target of the fishing activity. Reports of marine mammal injuries or mortalities incidental to commercial fishing operations have been obtained from fisheries reporting programs (self-reporting or logbooks), observer programs, and reports in the literature. The only reports of fatal takes of beluga whales incidental to commercial salmon gillnet fishing in Cook Inlet are from the literature. Murray and Fay (1979) stated that salmon gillnet fisheries in Cook Inlet caught five beluga whales in 1979. Incidental take rates by commercial salmon gillnet fisheries in the Inlet were estimated at three to six beluga whales per year during 1981-1983 (Burns and Seaman 1986). Neither report, however, differentiated between the set gillnet and drift gillnet fisheries. There have been sporadic reports over the years of single beluga whales becoming entangled in fishing nets, however, mortalities could not be confirmed.

More recently, NMFS placed observers in the Cook Inlet salmon drift net and upper and lower Inlet set gillnet fisheries in 1999 and 2000. During the two years of observations, only three sightings of beluga whales occurred and no beluga whale injuries or mortalities were reported. Furthermore, during the period 1990 and 2000, fishermen's voluntary self-reports indicated no mortalities of beluga whales from interactions from commercial fishing. NMFS has found the current rate of direct mortality from commercial fisheries in Cook Inlet appears to be insignificant and should not delay recovery of these whales.

ii) 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 any significant or measurable effect on Cook Inlet beluga whales.

e) 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.

i) 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.

ii) 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.

iii) 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.

iv) 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.

v) 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.

vi) 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.

f) Development: Southcentral Alaska is the State's most populated and industrialized area. 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.

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.

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.

g) 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.

h) 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.

i) 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.

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.

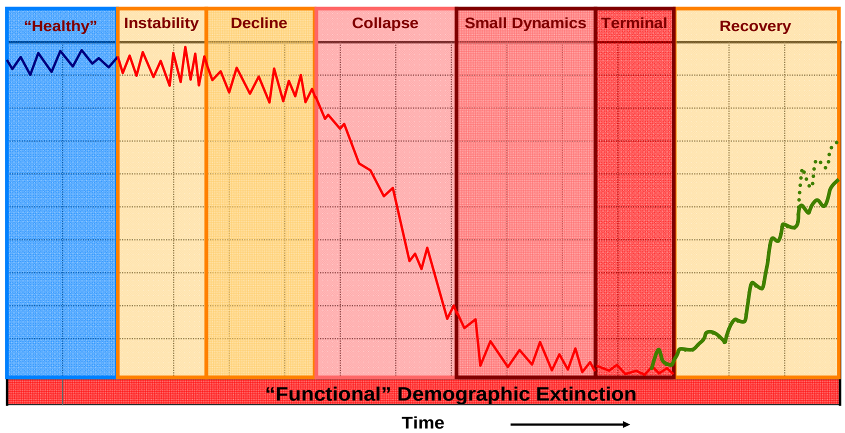
Although captive beluga whales have provided some insight into beluga hearing and the levels of noise that might damage their hearing capabilities, much less information is available on how noise might impact beluga whales behaviorally in the wild. Alaska Native beluga whale hunters with CIMMC have said 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.

Summary – Cook Inlet Beluga Whale

The Cook Inlet beluga whale exists as a small and distinct population that is both physically and genetically isolated from other beluga stocks. The population may have numbered over 1,300 prior to unsustainable levels of removals by subsistence hunting over several decades. The population is now estimated at 375 whales and has been designated as endangered under the ESA. Our best population model places the risk of extinction at 26 percent within the next 100 years. The additional annual loss of even a single whale would add significantly to this probability (NMFS 2008). The Cook Inlet population/DPS can be considered to have collapsed (see figure 7) and now lies within the "small population dynamics" phase. Here, certain biological factors and stochastic (random) events are expected to have disproportionally larger impacts on the population. Beluga whales have a low calving rate, giving birth to a single calf every two to three years. The Cook Inlet beluga has a small range and appears confined to this Inlet. Because these whales occupy the most populated and developed region of the state, they must compete with various anthropogenic stressors, including habitat development, pollution, and harassment. These whales often occur in dense aggregations within small nearshore areas, where they are predisposed to adverse effects such as oil spills, poaching, pollution, ship strikes, and disease outbreaks. Strandings are not uncommon for Cook Inlet belugas, and have resulted in deaths due to prolonged exposure. Killer whales foray into the upper Inlet to feed on beluga whales. This predation is an example of disproportionate impact associated with the "small population dynamics" phase. A pod of killer whales may take ten Cook Inlet belugas annually. A population of one thousand could easily sustain that level of removal, but at an abundance of 400 beluga whales, this predation rate would represent a large portion of that year's recruitment/growth. The longer a population exists within the "small population dynamics" zone, the higher the risk of extinction. Unfortunately, the Cook Inlet beluga may exist at this stage for some time because of its low abundance, low growth potential, and the lack of observed recovery despite restriction of what we believed to be the principle stressor to the population; subsistence harvests. *Throughout this critical stage, NMFS believes extraordinary caution is warranted for any actions that may impair the performance of individuals within this DPS.*

Figure 7. Phases of the Extinction Process



IV. EFFECTS of the ACTION

We have considered the specific aspects of the expansion project that may adversely affect Cook Inlet beluga whales. NMFS has separately considered the proposed dredging programs associated with this work, and concurred with the BA's determination that those actions were not likely to adversely affect these whales. With that determination, formal consultation is not necessary for that compartment 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.

Direct Effects on Cook Inlet Beluga Whales

a) Noise: 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].

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.

[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 these authorizations at 125 dB.

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.

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

Table 1. Representative Noise Levels of Sources (Continued)

Noise Source	Frequency Range (Hz)	Noise Level from Source	Reference
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 Port of Anchorage	data not available	144 dB RMS at 35 m	Scientific Fishery Systems, Inc. 2009

Number of Whales Taken per Year
The estimated number of beluga whales potentially exposed to noise levels above the NMFS thresholds was calculated by multiplying the average density per month by the number of hours pile driving per month, then multiplied by the area of noise exposure. Using this method, NMFS is proposing to authorize up to 34 beluga whale Level B harassment takes per year (or 9 percent of the population), the current level authorized in their MMPA permit.

Table 2 Summary of Acoustic Measurements and Estimated Source Levels and Isopleth Distances

Description	Worst-Case Measured Level (dB RMS)	Frequency Range (Hz)	Calculated Source Level (at 1 m)	Calculated Distance to 190 dB RMS (m)	Calculated Distance to 180 dB RMS (m)	Calculated Distance to 160 dB RMS (m)	Calculated Distance to 125 dB RMS (m)
Sheet pile – average, vibratory	NA	100-400	187 dB	NA	<10 m	NA	1,300 m
Sheet pile - face wall, vibratory	140 dB at 757 m	100-4,000	198 dB	2.6	8.2	82.2	4257
Sheet pile - face wall, impact, deep	148 dB at 355 m	8,000-10,000	200 dB	3.1	9.7	96.9	NA
Sheet pile - face wall, impact, shallow	157 dB at 78 m	20-200, 6,000	195 dB	1.8	5.7	56.8	NA
Sheet pile - tail wall, vibratory	120 dB at 107 m	200-400	161 dB	--	--	1.1	60
Sheet pile - tail wall, impact	139 at 268 m	2,000-7,000	188 dB	--	2.4	23.8	NA
Wye pile, vibratory	139 dB at 149 m	2,500-4,000	182 dB	--	1.3	13.2	747
Wye pile, impact	148 dB at 155 m	8,000-10,000	195 dB	1.7	5.4	54.1	NA
Round pile, vibratory (only)	144 dB at 35 m	200-4,500	175 dB	--	--	5.6	312
Hairpin, impact	143 dB at 106 m	Not provided	183 dB	--	1.4	14.2	NA

This table summarizes the worst-case, or maximum, level that was measured over the 14-day period for each pile type and installation. All sound levels are reported in dB re 1 µPa.

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). Impacts to beluga whales exposed to loud sounds include possible mortality (either directly from the noise or indirectly based on the reaction to the noise), injury and/or disturbance ranging from severe (e.g., permanent abandonment of vital habitat) to mild (e.g., startle). As stated, pile driving and in-water chipping (for demolition of the existing dock) could cause behavioral harassment; however, physical injury is not anticipated due to the nature of the operations and mitigation measures. No Level A harassment (injury) or mortality is expected to occur.

Hearing Impairment and Other Physical Effects

Temporary or permanent hearing impairment is a possibility when beluga whales are exposed to very loud sounds. As stated previously, NMFS considers the Level A in-water harassment threshold to be 180 dB for cetaceans. The threshold for Level B harassment from pulsed noise (e.g, impact pile driving) is 160 dB and, specific to the MTR project, 125 dB from non-pulsed noise (e.g., vibratory pile driving, chipping). Several aspects of the planned monitoring and mitigation measures for the MTR project are designed to detect marine mammals occurring near pile driving and demolition activities, and to avoid exposing them to sound that could potentially cause hearing impairment (e.g., mandatory shut down zones) and minimize disturbance (e.g., shut down if allocated takes used, for large groups and groups with calves). In addition, marine mammals will be given a chance to leave the area during soft start and ramp-up procedures to avoid exposure to full energy pile driving. In those cases, the avoidance responses of the animals themselves will likely reduce or eliminate any possibility of hearing impairment. Hearing impairment is measured in two forms: temporary threshold shift and permanent threshold shift.

Permanent Threshold Shift (PTS)

When permanent threshold shift (PTS) occurs, there is physical damage to the sound receptors in the ear. In some cases, there can be total or partial deafness, whereas in other cases, the animal has an impaired ability to hear sounds in specific frequency ranges. PTS consists of non-recoverable physical damage to the sound receptors in the ear and is therefore classified as Level A harassment (injury) under the MMPA. There are no empirical data for onset of PTS in any marine mammal; therefore, PTS-onset must be estimated from temporary threshold shifts (TTS)-onset measurements and from the rate of TTS growth with increasing exposure levels above the level eliciting TTS-onset. PTS is presumed to be likely if the hearing threshold is reduced by 40 dB (i.e., 40 dB of TTS) (Southall et al., 2007). PTS has never been measured in marine mammals despite some hearing threshold studies exposing beluga whales to pulses up to 208 dB (Finneran et al., 2002), 28 dB louder than NMFS's current Level A harassment threshold. Based on TTS studies (discussed below), proposed mitigation measures, and source levels for the MTRP, NMFS does not expect that cook inlet beluga whales will be exposed to levels that could elicit PTS (i.e., no Level A harassment is anticipated).

Temporary Threshold Shift (TTS)

Temporary (auditory) threshold shift (TTS) is a slight, recoverable loss of hearing sensitivity. TTS is the mildest form of hearing impairment that can occur during exposure to a loud sound (Kryter, 1985). The course and time of recovery generally depend on the amount of exposure to noise and the amount of shift incurred (Natchigall et al., 2003). Generally, the greater the threshold shift, the longer the recovery period (Mills et al., 1979). Southall et al. (2007) considers a 6 dB TTS (i.e., baseline thresholds are elevated by 6 dB) sufficient to be recognized as an unequivocal deviation and thus a sufficient definition of TTS-onset. Auditory fatigue (i.e., TTS) in mid-frequency cetaceans has been measured after exposure to tones, impulsive sounds, and octave-band noise. Because it is non-injurious, NMFS considers TTS as Level B harassment that is mediated by physiological effects on the auditory system; however, NMFS does not consider onset TTS to be the lowest level at which Level B Harassment may occur. While experiencing TTS, the hearing threshold rises and a sound must be louder in order to be heard. TTS can last from minutes or hours to (in cases of strong TTS) days. For sound exposures at or somewhat above the TTS-onset threshold, hearing sensitivity recovers rapidly after exposure to the noise ends. Few data on sound levels and durations necessary to elicit mild TTS have been obtained for marine mammals. For toothed whales exposed to single short pulses, the TTS threshold appears to be, to a first approximation, a function of the energy content of the pulse (Finneran et al., 2002).

Laboratory experiments investigating TTS onset for belugas have been conducted for both pulse and non-pulse sounds. Finneran et al. (2000) exposed a trained captive beluga whale to a single pulse from an explosion simulator. No TTS threshold shifts were observed at the highest received exposure levels (approximately 199 dB; 179 dB re 1 μPa2-s [SEL]); however, amplitudes at frequencies below 1 kHz were not produced accurately to represent predictions for the explosions. Another study was done using seismic waterguns with a single acoustic pulse (Finneran et al., 2002). Measured TTS was 7 and 6 dB in the beluga at 0.4 and 30 kHz, respectively, after exposure to intense single pulses at approximately 208 dB (186 dB re 1 microPa2-s [SEL]). Schludt et al. (2000) demonstrated temporary shifts in masked hearing thresholds for belugas occurring generally between 192 and 201 dB (192-201 dB re 1 μPa2-s [SEL]) after exposure to intense, non-pulse, 1-s tones at 3, 10, and 20 kHz. TTS onset occurred at mean sound exposure level of 195 dB (195 dB re 1 microPa2- s [SEL]). At 0.4 kHz, no subjects exhibited shifts after exposures up to SPLs of 193 dB (195 dB re 1 microPa2- s [SEL]). Natchigall et al. (2003) measured TTS averaging 11 dB when exposed to sounds with a 7.5 kHz center frequency. No shifts were obtained at 165 dB or 171 dB (198 to 200 re 1 microPa2-s [SEL]), but when a fatiguing noise at 179 dB was presented, the animal showed the first TTS of 10.4 dB above baseline. Full auditory recovery occurred within 45 minutes following noise exposure.

To date, no studies relating TTS onset to pile driving sounds have been conducted for any cetacean species. Because noise from pile driving would not be a one-time exposure, as with most human development and exploration activities, a time component must be incorporated into any effects analysis. Experiments with marine mammals show a nearly linear relationship between sound exposure level and duration of exposure: the longer an animal is exposed, the lower the level required to produce TTS (Kastak & Schusterman, 1999; Schlundt et al., 2000; Nachtigall et al., 2003). Beluga whales could be exposed to vibratory pile driving noise lasting from less than 1 minute up to approximately 3 minutes or up to 20 minutes for impact driving (averaging 1.5 minutes for vibratory and 6 minutes for impact pile driving). The hammers must then be re-set creating, at a minimum, a 1-15 minute break. Using auditory evoked potentials (AEP) methods, Natchigall et al. (2004) repeated his 2003 study and found TTS of approximately 4 to 8 dB following nearly 50 minutes of exposure to the same frequency noise (center frequency 7.5 kHz) at 160 dB (193-195 dB re 1 microPa2-s [SEL]). TTS recovery occurred within minutes or tens of minutes. Based on data from the aforementioned studies, the fact that pile driving would only occur for a short intervals of time, and animals would not be exposed to sound levels at or above 180 dB due to proposed mitigation, NMFS anticipates that TTS, if it does occur, would not last more than a few minutes and would likely not result in impacts to vital life functions such as communication and foraging.

Demolition Effects

Demolition of the existing dock will require use of mechanical equipment such as hydraulic chipping hammers (in-water or out-of-water) and possibly the use of explosives (out-of-water only). The POA/MARAD have submitted a demolition plan outlining three options, as described above, for dock removal and proposed mitigation for each.

Mechanical means of removing the dock is a component in all three options. The POA/MARAD have indicated that if the in-water dock demolition method is chosen (Option 1), it will likely occur during the winter, when beluga whales are least abundant, or in summer, but not in both seasons. Information on noise levels associated with the use of chipping hammers is currently not available for the unique waters of Knik Arm; however, the chipping hammer operates at 19% less horsepower than the vibratory hammers used during pile driving. Therefore, it can be assumed that sound transmission from this activity is less than that of pile driving. 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. Due to the lack of empirical acoustic propagation data, the POA/MARAD have requested, and NMFS is proposing, to implement the same harassment and safety radii as vibratory pile driving. Based on this precautionary approach, considering the chipping hammer works at 19 percent reduced energy and the concrete will absorb some sound, NMFS has preliminarily determined that marine mammals would not be exposed to levels inducing Level A harassment and behavioral harassment would be minimized, if not eliminated, due to implementing a 200 m shut-down zone.

Option 2 in the demolition plan involves blasting, albeit out-of-water. Because no in-water blasting is proposed, applying NMFS's harassment threshold criteria for this activity is not appropriate. Instead, the POA/MARAD and NMFS have considered sound transmission through the water's surface from out-of-water detonations. Little information is available for over-water sound levels from explosives near shore (out-of-water); however, two studies conducted by the California Department of Transportation (Caltrans) have measured in-water sound transmission resulting from out-of-water blasting.

In 2003, Caltrans collected measurements of underwater SPLs during out-of-water controlled blasting operations as part of the construction of bridge pier footings on Yerba Buena Island for the San Francisco Oakland Bay Bridge, East Span Seismic Safety Project (Caltrans, 2004). In-water SPLs were measured during out-of-water blasts for two different piers approximately, from the centerline, 80 m (262 ft) and 30 m (98 ft) from the shoreline. Results varied at each pier for each blast; however, in general, SPLs measured at 10- 20 m ranged from 170 to 183 dB (based on a 35 millisecond (msec) time constant) for the pier 80 m from the shoreline and 177 to 198 dB [189 to 212 dB(peak)] for the pier 30 m from shore. It should be noted that rms SPLs reported using the 35-msec time constant was found to be 3-5 dB higher than true rms SPL measured over the duration of the impulse, which is about 1 to 2 seconds in duration; therefore, the SPLs provided above should be considered conservative. Data from blasting events at both piers indicated that underwater SPLs appeared to increase as blasting was conducted at lower elevations; putting the blast closer to the water.

Dewatered cofferdams represent the most effective way of reducing construction/ demolition created noise into the water column because all operations are completely decoupled from the surrounding water column. The POA/MARAD would create a dike which acts like a cofferdam as in the Caltrans project. The out-of-water blasting at the POA would occur 91m (300 ft) from shore and the blasts would be confined (unlike Caltrans); therefore, sound levels in water would likely be similar or less than the results from the Caltrans pier located 80m from the shoreline but likely not greater. Based on Caltran results, no Level A harassment is likely to occur and the POA/MARAD have agreed, as suggested by NMFS, to not conduct any blasting if any marine mammal, is within visible range of the POA. MMOs would begin scanning for marine mammals thirty minutes prior to detonation with high power binoculars and the naked eye. Should any marine mammal be sighted, blasting will be delayed. Therefore, NMFS anticipates no harassment from out-of-water blasting will occur.

Non-auditory Physiological Effects

Non-auditory physiological effects or injuries that theoretically might occur in beluga whales exposed to strong underwater sound include stress, neurological effects, bubble formation, resonance effects, and other types of organ or tissue damage. Due to proposed mitigation measures (e.g., mandatory shut downs) beluga whales would not be exposed to sound at or above 180 dB and likely less than that as sound studies indicate the 180/190 dB threshold is approximately 0-20 m from pile driving and NMFS is proposing a 200m shut down zone. Therefore, it is not expected that severe physiological effects from exposure to sound would be expected; however, a hormonal stress response is possible. Romano et al. (2004) demonstrated that belugas exposed to seismic water gun and (or) single pure tones (SPLs up to 201 dB) resembling sonar pings showed increased stress hormone levels of norepinephrine, epinephrine, and dopamine. While RLs would not be as strong as the ones in that study, a stress response would not be unexpected. However, in two studies, exposure of captive beluga whales to playbacks of drilling noise did not result in increased levels of (stress-related hormones) (API, 1986; Thomas, Kastelein, and Awbrey, 1990). Wright et. al (2007) concluded that anthropogenic noise, either by itself or in combination with other stressors, can reduce the fitness of individual marine mammals and decrease the viability of some marine mammal populations. The available literature suggests stress hormone levels may be affected by noise exposure, but that the results are highly variable and dependent (in part) upon factors such as the duration, frequency, and intensity of sound, the species of marine mammal, the individual's response, and the amount of control the individual has over the stressor. The physiological effects of any elevation in hormone levels are equally variable.

Studies have also demonstrated that reactions of animals to sounds could result in physical injury. It has recently been reported that stranded deep diving marine mammals displayed physical attributes similar to the bends (e.g., in vivo gas bubble formation) (Fernandez et al., 2005, 2006). Marine mammals may experience these symptoms if surfacing rapidly from deep dives in response to loud sounds. However, because Knik Arm is a shallow water estuary, marine mammals found there are not considered deep divers, and due to proposed mitigation measures, non-auditory physiological impacts, other than stress, are not expected.
Several aspects of the planned monitoring and mitigation measures for the MTRP are designed to detect beluga whales occurring near pile driving and to avoid the chance of them being exposed to sound levels which could result in injury or mortality. NMFS does not expect Level A harassment to occur.

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 (i.e., 1 s tones), 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 call to 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, also 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 MTRP; 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 the IHA 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.

As in the 2008 IHA, NMFS is proposing to implement the following mitigation measure into regulations to ensure that exposure to pile driving does not result in decreased reproductive success or survivorship: 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.

Long-term observations of beluga whales in Knik Arm suggest that construction activities are not influencing beluga whale abundance or habitat use around the Port. 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 behavioral reactions are possible, monitoring reports from the Port show no apparent observable reaction of Cook Inlet beluga whales to construction noises. 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. 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. 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.

b) Habitat Loss and Diminished Use: 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 had considered the habitat value on the area to be filled during the NEPA process 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 were relatively shallow channels where fish were confined or concentrated by bottom structure (Frost 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.

Indirect Effects on Cook Inlet Beluga Whales.

a) Vessel Traffic: Vessels traveling within the action area can be a threat to beluga whales. The potential for ship strikes exists whenever ships and belugas are in the area at the same time. While ship strikes have not been definitively confirmed in a Cook Inlet beluga whale death, in October 2007 a dead whale washed ashore with "wide, blunt trauma along the right side of the thorax" (NMFS unpubl. data), suggesting a ship strike was the cause of the injury. Vessel traffic can also produce noise disturbance to beluga whales and pollution from the vessels may decrease the quality of their habitat.

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. Beluga whales are regularly sighted in and around the Port (Rugh et al. 2005a) passing near or under vessels (Blackwell and Greene 2002), indicating that these animals may have a high tolerance of large vessel traffic. However, smaller boats that travel at high speed and change direction often present a greater threat. In Cook Inlet, the concentration of beluga whales near river mouths predisposes them to strikes by high speed watercraft associated with sport fishing and general recreation. High-speed vessels operating in these whale concentration areas have an increased probability of striking a whale, as evidenced by observations of Cook Inlet belugas with propeller scars (Burek 1999). Small boats and jet skis, which are becoming more abundant in Cook Inlet and the Knik Arm, are also more likely to approach and disturb any whales that are observed. However, such vessels are not considered a direct or indirect aspect of the expansion project.

The carrying capacity of the Port is currently at or exceeding the facility capabilities. 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 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 was an accidental spill.

b) 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, nor disposal of dredged sediments is currently a significant stressor with respect to 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 MTRP 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.

i) 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.

ii) 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."

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 Cook Inlet belugas.

V. 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 be as have been 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 be contacted.

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 or they avoid interactions with vessels, or that interactions usually result in the death of the animals.

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.

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.

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.

VI. CONCLUSION

This Biological Opinion has considered the direct, indirect, and cumulative effects of the Port of Anchorage expansion project on the Cook Inlet beluga whale. The proposed action is expected to result in direct and indirect impacts to these whales. We estimate thirty four (34) whales may be taken annually during the term of the MMPA authorization (i.e. construction period) by harassment. This harassment is not likely to result in injury or death. After construction, some whales will be exposed to increased noise due to operation of the Port. Again, it is unlikely this exposure would cause injury or mortality, although individual whales may alter their behavior for a brief period of time. An accounting of the probable level of removals associated with other anthropogenic actions, and a projection of the cumulative impacts to this population, does not suggest the current trends in this population would be altered. We also note that 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.

The November 2008 Status Review included an extinction risk assessment of the Cook Inlet DPS of beluga whales. That assessment concluded that, for the model scenario considered to best represent the current condition of the stock, the probability of extinction was 26 per cent within the next 100 years. Further, even the addition of a single annual mortality event above the assumptions of the model increased this probability significantly. No mortalities (or injurious takes) are anticipated due to this project, and therefore the work should not alter these population projections. We also considered sub-lethal impacts such as harassment or habitat loss to this DPS. We have no evidence that the habitat use or value of the action area would be significantly diminished due to the construction or operation of the port, although there exists little in specific research on this issue. Observational data support the conclusion that beluga whales continue to occupy the project area despite construction and operational activity, although we do not know whether their behavior within the area, or use of it, may have changed. Certainly harassment has health implications through potential effects on stress, behavior, distribution, and movement, but such effects remain undescribed and unproven for this DPS. The estimated 34 whales to be taken by noise harassment due to this action are most likely to display only minor behavioral reactions which should not persist after they are beyond the area of exposure, and are not expected to have chronic effects on individuals. It is possible 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.

Therefore, after reviewing the current status of the Cook Inlet beluga whale, the environmental baseline for the action area, the biological and physical impacts of the Port of Anchorage expansion project, and cumulative effects, it is NOAA Fisheries's biological opinion this action is not likely to jeopardize the continued existence of the Cook Inlet beluga whale. In supporting this conclusion, it is important to note that this is an on-going action which has not resulted in injury or morality, has not exceeded the expected level of take, and for which the mitigative and monitoring efforts appear to have been effective. No critical habitat has yet been designated for this species, therefore none will be affected.

VII. 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. The National Marine Fisheries Service recommends MARAD implement the following measures for these purposes:

The MARAD should 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 final report is to be provided to NMFS no later than 2 years prior to completion of construction.

VIII. INCIDENTAL TAKE STATEMENT

Section 9 of the ESA and Federal regulations pursuant to section 4(d) of the ESA prohibit the take of endangered and threatened species, respectively, without special exemption. Take is defined as to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture or collect, or to attempt to engage in any such conduct. Incidental take is defined as take that is incidental to, and not the purpose of, the carrying-out of an otherwise lawful activity. Under the terms of section 7(b)(4) and section 7(o)(2), taking that is incidental to and not intended as part of the agency action is not considered to be prohibited under the ESA provided that such taking is in compliance with the terms and conditions of an incidental take statement.

The measures described below are nondiscretionary, and must be undertaken by the Maritime Administration (MARAD) and NMFS so that they become binding conditions of any grant or permit issued, as appropriate, for the exemption in section 7(o)(2) to apply. MARAD has a continuing duty to regulate the activity covered by this incidental take statement. If MARAD or NMFS (1) fails to assume and implement the terms and conditions, or (2) fails to require the applicant to adhere to the terms and conditions of the incidental take statement through enforceable terms that are added to the permit or grant document, the protective coverage of section 7(o)(2) may lapse. In order to monitor the impact of incidental take, MARAD must monitor the progress of the action and its impact on the species as specified in the incidental take statement (50 CFR 402.14(i)(3)). Section 7(b)(4) of the Endangered Species Act (ESA) requires that when a proposed agency action is found to be consistent with section 7(a)(2) of the ESA and the proposed action may incidentally take individuals of listed species, NMFS will issue a statement that specifies the impact of any incidental taking of endangered or threatened species. It also states that reasonable and prudent measures, and terms and conditions to implement the measures, be provided that are necessary to minimize such impacts. Only incidental take resulting from the agency action and any specified reasonable and prudent measures and terms and conditions identified in the incidental take statement are exempt from the taking prohibition of section 9(a), pursuant to section 7(o) of the ESA.

Amount or Extent of Take

Available information indicates that incidental acoustic harassment of small numbers of Cook Inlet beluga whales may occur during the port expansion. NMFS does not expect any whales to be injured or killed by the project. Planned monitoring and mitigation measures are designed to detect marine mammals occurring near the port, and to avoid exposing them to sounds that may cause hearing impairment, injury, or death. NMFS estimates the annual take associated with the proposed action to be thirty four (34) whales. All takes would be due to non-injurious harassment. The amount of take will have been exceeded if any Cook Inlet beluga whales are harmed, injured, or killed as a result of exposure to noise from the Port of Anchorage expansion project, or if the number of whales “taken” by harassment exceeds the maximum estimate of 34.

Effect of the Take

This biological opinion concludes that the subject activities are not likely to result in jeopardy to the Cook Inlet beluga. Exposure to construction and operational noise and other sound sources associated with this work has the potential to harass Cook Inlet beluga whales, although such takes are expected to be temporary and not to affect the reproduction, survival, or recovery of this species.

Reasonable and Prudent Measures

NMFS believes the following reasonable and prudent measures are necessary and appropriate to minimize impacts of incidental take of bowhead whales: 1) the requirements and conditions within any authorization by NOAA (Letter of Authorization) for the incidental and unintentional take of Cook Inlet beluga whales are met.

Terms and Conditions

In order to be exempt from the prohibitions of section 9 of the Act, compliance with the following terms and conditions is required. These terms and conditions are non-discretionary.

(1) Through monitoring described in the Letter of Authorization, the Holder of the Letter of Authorization will ensure that no marine mammal is subjected to a SPL of 180 dB re: 1 microPa or greater.

(2) If a marine mammal is detected within or approaching the Level B harassment zone designated for impact pile driving (350 m) prior to in-water impact pile driving or chipping, operations shall not commence until the whale moves outside this zone or the animal is not detected within 15 minutes of the last sighting.
(3) If a marine mammal is detected within or approaching the Level B harassment zone designated for vibratory pile driving (1,300 m) prior to in-water vibratory pile driving, operations shall not commence until the whale moves outside these designated zones or the animal is not detected within 15 minutes of the last sighting.
(4) A soft start technique shall be used at the beginning of each day's in-water pile driving activities or if pile driving has ceased for more than one hour to allow any marine mammal that may be in the immediate area to leave before piling driving reaches full energy. For vibratory hammers, the soft start requires the holder of the Letter of Authorization to initiate noise from the hammers for 15 seconds at reduced energy followed by 1-minute waiting period and repeat the procedure two additional times. If an impact hammer is used, the soft start requires an initial set of three strikes from the impact hammer at 40 percent energy, followed by a one minute waiting period, then two subsequent 3-strike sets.
(5) In-water pile driving or chipping shall not occur when conditions restrict clear, visible detection of all waters within harassment zones. Such conditions that can impair sightability include, but are not limited to, fog and rough sea state.
(6) In-water impact pile driving shall not occur during the period from two hours before low tide until two hours after low tide.
(7) The following measures apply to all in-water pile driving, except during the stabbing phase, and all in-water chipping associated with demolition of the existing dock:
(i) No in-water pile driving (impact or vibratory) or chipping shall occur if any marine mammal is located within 200m of the hammer in any direction. If any marine mammal is sighted within or approaching this 200m safety zone, pile-driving or chipping must be suspended until the animal has moved outside the 200m safety zone or the animal is not resighted within 15 minutes.
(ii) If a group of more than 5 beluga whales is sighted within the Level B harassment isopleths, in-water pile driving or chipping shall cease. If the group is not re-sighted within 15 minutes, pile driving or chipping may resume.
(iii) If a beluga whale calf or group with a calf is sighted within or approaching a harassment zone, in-water pile driving and chipping shall cease and shall not be resumed until the calf or group is confirmed to be outside of the harassment zone and moving along a trajectory away from such zone. If the calf or group with a calf is not re-sighted within 15 minutes, pile driving or chipping may resume.
(8) If maximum authorized take is reached or exceeded, any marine mammal entering into the harassment or safety isopleths will trigger mandatory in-water pile driving shut down.
(9) For Port of Anchorage-operated in-water heavy machinery work other than pile driving or chipping (i.e., dredging, dump scows, tug boats used to move barges, barge mounted hydraulic excavators, or clamshell equipment used to place or remove material), if a marine mammal comes within 50 m, those operations will cease and vessels will reduce to the slowest speed practicable while still maintaining control of the vessel and safe working conditions.

(10) In the event the Port of Anchorage conducts out-of-water blasting, detonation of charges will be delayed if a marine mammal is detected anywhere within a visible distance from the detonation site.
(11) The Holder of the Letter of Authorization must notify the Administrator, Alaska Region, NMFS, by letter, e-mail, or telephone, at least 2 weeks prior to commencement of seasonal activities and dock demolition possibly involving the taking of marine mammals. If the activity is thought to have resulted in the mortality or injury of any Cook Inlet beluga whale, the Holder of the Letter of Authorization must notify the Director, Office of Protected Resources, NMFS, or designee, by e-mail or telephone (301-713-2289), within 24 hours of the discovery of the injured or dead animal.
(12) The Holder of a Letter of Authorization must designate qualified, on-site individuals approved in advance by NMFS, as specified in the Letter of Authorization, to:
1) Conduct visual marine mammal monitoring at the Port of Anchorage beginning 30 minutes prior to and during all in-water pile driving or chipping and out-of-water blasting.
2) Record the following information on NMFS-approved marine mammal sighting sheets whenever a marine mammal is detected:
(i) Date and time of initial sighting to end of sighting, tidal stage, and weather conditions (including Beaufort Sea State);
(ii) Species, number, group composition (i.e., age class), initial and closest distance to pile driving hammer, and behavior (e.g., activity, group cohesiveness, direction and speed of travel, etc.) of animals throughout duration of sighting;
(iii) Any discrete behavioral reactions to in-water work;
(iv) The number (by species) of marine mammals that have been taken;
(v) Pile driving, chipping, or out of water blasting activities occurring at the time of sighting and if and why shut down was or was not implemented.
3) Employ a marine mammal monitoring team separate from the on-site marine mammal observers (MMOs), to characterize beluga whale abundance, movements, behavior, and habitat use around the Port of Anchorage and observe, analyze, and document potential changes in behavior in response to in-water construction work. This monitoring team is not required to be present during all in-water pile driving operations but will continue monitoring one-year post in-water construction. The on-site MMOs and this marine mammal monitoring team shall remain in contact to alert each other to marine mammal presence when both teams are working.
(13) In-water piles will be driven with a vibratory hammer to the maximum extent possible (i.e., until a desired depth is achieved or to refusal) prior to using an impact hammer.

IX. REINITIATION of CONSULTATION

This concludes formal consultation on this action. As provided in 50 CFR 402.16, reinitiation of consultation is required where discretionary Federal agency involvement or control over the action has been retained and if: (1) the amount or extent of taking specified in the incidental take statement is exceeded; (2) new information reveals effects of this action that may affect listed species or critical habitat in a manner or to an extent not previously considered in this biological opinion; (3) the identified action is subsequently modified in a manner that causes an effect to the listed 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 identified action.

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