UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic Atmospheric Administration
National Marine Fisheries Service
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Endangered Species Act (ESA) Section 7(a)(2) Biological Opinion
Port of Anchorage Test Pile Project and Associated Proposed Issuance of Incidental Harassment Authorization and NWP Verification

NMFS Consultation Number: AKR-2016-9513

Action Agencies: NOAA/NMFS Office of Protected Resources, Permits Division
U.S. Army Corps of Engineers, Alaska District

Affected Species and Determinations:

ESA-Listed Species	Status[1]	Determination of effects on species	Determination of effects on critical habitat	Likely To Jeopardize?	Likely To Destroy or Adversely Modify Critical Habitat?
Cook Inlet beluga whale (*Delphinaptera leucas*)	E	Likely to adversely affect	No effect	No	No
Steller Sea Lion, Western DPS (*Eumatopias jubatus*)	E	Likely to adversely affect	No effect	No	No

[1]E = endangered, T = threatened

Consultation Conducted By: National Marine Fisheries Service, Alaska Region

Issued By:

FOR James W. Balsiger, Ph.D.
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1.0. INTRODUCTION

1.1 Background

Section 7(a)(2) of the Endangered Species Act of 1973, as amended (ESA; 16 U.S.C. 1536(a)(2)) requires each Federal agency to ensure that any action it authorizes, funds, or carries out is not likely to jeopardize the continued existence of any endangered or threatened species or result in the destruction or adverse modification of critical habitat of such species. When a Federal agency's action may affect a protected species, that agency is required to consult with the National Marine Fisheries Service (NMFS) or the U.S. Fish and Wildlife Service (USFWS), depending on the species or critical habitat that may be affected (50 CFR §402.14(a)). The jeopardy analysis conducted by NMFS or USFWS considers both survival and recovery of the species. The adverse modification analysis considers the impacts to the conservation value of the designated critical habitat.

"To jeopardize the continued existence of a listed species" means to engage in an action that would be expected, directly or indirectly, to reduce appreciably the likelihood of both the survival and recovery of a listed species in the wild by reducing the reproduction, numbers, or distribution of that species (50 CFR 402.02). As NMFS explained when it promulgated this definition, NMFS considers the likely impacts to a species' survival as well as likely impacts to its recovery. Further, it is possible that in certain exceptional circumstances, injury to recovery alone may result in a jeopardy biological opinion (51 FR 19926, 19934 ((June 2, 1986)).

This opinion does not rely on the regulatory definition of "destruction or adverse modification" of critical habitat at 50 C.F.R. 402.02. Instead, we have relied upon the statutory provisions of the ESA to complete the following analysis with respect to critical habitat. [1]

Section 7(b)(3) of the ESA requires that at the conclusion of consultation, NMFS and/or USFWS provide an opinion stating how the Federal agencies' actions will affect ESA-listed species and their critical habitat. If the action is not likely to jeopardize the species but incidental take of the species is expected, section 7(b)(4) requires the consulting agency to provide an incidental take statement (ITS) that specifies the impact of any incidental taking and includes reasonable and prudent measures to minimize such impacts.

Under sections 101(a)(5)(A) and (D) of the Marine Mammal Protection Act (MMPA), the Secretary of Commerce, through NMFS, may authorize incidental take to U.S. citizens and U.S.-based companies, if NMFS finds that the taking would (a) be of small numbers, (b) have no more than a "negligible impact" on those marine mammal species or stocks, and (c) not have an "unmitigable adverse impact" on the availability of the species or stock for "subsistence" uses; and if the permissible methods of taking and

[1] Memorandum from William T. Hogarth to Regional Administrators, Office of Protected Resources, NMFS (Application of the "Destruction or Adverse Modification" Standard Under Section 7(a)(2) of the Endangered Species Act) (November 7, 2005).

requirements pertaining to the mitigation, monitoring and reporting of such takings are set forth.

The actions that are the subject of this consultation are: (a) NMFS Office of Protected Resources – Permits and Conservation Division's (Permits Division) proposed issuance of an Incidental Harassment Authorization (IHA) to take marine mammals by harassment under the MMPA incidental to the Port of Anchorage (POA) proposed test pile project; and (b) the U.S. Army Corps of Engineers, Alaska District (Corps), proposed issuance of a permit for the test pile project (application file number POA-2003-502-M8, Knik Arm).

This document represents NMFS's biological opinion on the effects of the proposed actions on the endangered Cook Inlet beluga whale (*Delphinapterus leucas*) and on the endangered Steller sea lion (*Eumatopias jubatus*). This opinion and incidental take statement were prepared by NMFS Alaska Region (AKR) in accordance with section 7(b) of the ESA and implementing regulations at 50 CFR 402. This opinion and Incidental Take Statement are in compliance with the Data Quality Act (44 U.S.C. 3504(d)(1) *et seq*.) and have undergone pre-dissemination review. A complete record of this consultation is on file at NMFS's Anchorage Alaska office.

1.2. Consultation History

On February 15, 2015, NMFS Permits Division received from POA an application to authorize taking of marine mammals incidental to conducting the Test Pile Program as part of the Anchorage Port Modernization Project (APMP). The project was originally scheduled to occur during fall, 2015. The Corps and Permits Division originally requested formal consultation on May 21, 2015 and June 2, 2015 respectively. Due to scheduling delays, the project time frame was shifted to the spring of 2016. POA submitted a revised application on November 23, 2015. NMFS Permits Division determined that the application was adequate and complete on November 30, 2015. On December 16, 2015, NMFS Permits Division published in the Federal Register a proposed Incidental Harassment Authorization for Taking Marine Mammals Incidental to a Test pile Program (80 FR 78176). Formal consultation on this IHA proposal was re-initiated on December 30, 2015.

2.0. DESCRIPTION OF THE PROPOSED ACTION AND ACTION AREA

2.1. Proposed Action

"Action" means all activities or programs of any kind authorized, funded, or carried out, in whole or in part, by Federal agencies. 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.

The POA receives shipment of approximately 74 percent of all of all non-fuel freight and 95 percent of all refined petroleum product moving through Southcentral Alaska. Its existing infrastructure and support facilities were largely constructed in the 1960s; they are substantially past their design life, have degraded to levels of marginal safety, and are in many cases functionally obsolete. The APMP will include construction of new pile-supported wharves and trestles to the south and west of the existing terminals, with a

planned design life of 75 years.

The POA proposes to install 10 test piles to gather geotechnical and hydroacoustic data that will support the design of the APMP. The POA will test at least two methods of pile driving sound attenuation to determine which will be most effective for the larger project; an encapsulated bubble curtains and the adBM Resonance system. These systems have been shown to mitigate sound levels. One of the primary objectives of the Test Pile Program is to measure the amount of attenuation provided by these systems. These systems are expected to provide at least 10 dB noise reduction. Test pile driving is expected to be completed by July 1, 2016. However, to accommodate unexpected project delays and other unforeseeable circumstances, the requested and proposed IHA period for the Test Pile Program is for one year, from April 1, 2016, to March 31, 2017. Subsequent Corps permits and incidental take authorizations will be required to cover pile driving for the APMP construction, which is anticipated to last five years. The APMP is an action that is interrelated to the test pile project.

2.1.1. Proposed Activities

Pile Driving

The POA will drive ten 48-inch steel pipe indicator piles using a large vibratory hammer (to the point of refusal) followed by an impact hammer, or with only a very large impact pile hammer to depths of 175 feet (53 m) or more from a large derrick barge. It is estimated that vibratory installation of each pile will require approximately 30 minutes, and impact pile driving is estimated to require between 80 to 100 minutes per pile. An ICE 850 vibratory driver and a Delmag D100-13 diesel impact hammer or equivalent hammers will be used. Pile driving will be halted during installation of each pile as additional pile sections are added. Each indicator pile will take approximately 1 to 2 hours to install. Indicator test pile locations may be as much as 500 feet apart. Therefore, the time required to mobilize equipment to drive each indicator pile will likely limit the number of piles driven to one or perhaps two per day. These periods between pile driving will range from a few hours to a day in length to accommodate welding and inspections. It is expected that indicator pile tests will require approximately 4 weeks to complete.

Acoustic Monitoring - The POA will conduct acoustic monitoring for impact pile driving to determine the actual distances to the 190 decibels referenced to 1 microPascal (dB re 1μPa $_{RMS}$), 180 dB re 1μPa $_{RMS}$, and 160 dB re 1μPa $_{RMS}$ isopleths, which are used by NMFS to define the Level A injury and Level B harassment zones for pinnipeds and cetaceans for impulsive sounds. The POA will also conduct acoustic monitoring for vibratory pile driving to determine the actual distance to the 125 dB re 1μPa $_{RMS}$ isopleth for behavioral harassment from non-impulsive sounds (ambient levels are estimated to be 125 dB re 1μPa in the project area). See Section 6.1 for further description of NMFS acoustic criteria.

POA will use both stationary and vessel-based hydrophones. Stationary hydrophones will be placed at approximately 10 m from the active pile; this location will provide a continuous recording of the pile being driven. One or two vessels will deploy hydrophones to collect data to estimate the distance to far-field sound levels. Data will be monitored in real time. A complete description of acoustic monitoring details is provided in the IHA application (HDR/CH2MHill 2015).

The POA originally planned to test three sound attenuation methods: pile cushions, resonance-based systems (which use noise-canceling resonating slats around the pile being driven), and encapsulated bubble curtains to determine their relative effectiveness at attenuating underwater noise. However, industry-standard pile cushions are not available for 48-inch piles, so testing this means of sound attenuation has been eliminated from the study design (R. Pauline, pers. comm. 01/26/2016). As a result, two remaining sound attenuation methods will be tested. Encapsulated gas bubble curtains have been shown to attenuate noise levels to 40 dB, depending on frequency. The resonance-based passive noise abatement system (AdBm Technologies), which uses Helmholtz resonators in contrast to encapsulated bubbles, has been shown to reduce underwater noise by up to 50 dB (HDR/CH2M 2015a).

Underwater acoustic measurements will be monitored for each test pile by placing hydrophones (within a clear acoustic path to the test pile) at three locations: two stationary positions, one close (about 10 m), one distant, and one mobile (boat-based) position. Data collected from sound attenuation testing will inform future construction of the APMP. The POA will monitor hydroacoustic levels, as well as the presence and behavior of marine mammals during pile installation.

During the Test Pile Program, the contractor is expected to mobilize cranes, tugs, and floating barges, including one derrick barge up to 70 feet wide x 200 feet long. These barges will be moved into location with a tugboat. Cranes will be used to conduct overwater work from barges, which are anticipated to remain on-site for the duration of the Test Pile Program.

2.1.2. Mitigation Measures

Background – Acoustic Harassment criteria

NMFS uses generic sound exposure thresholds to determine when an activity produces sound intensities that can affect marine mammals (70 FR 1871, January 11, 2005). These acoustic thresholds identify the levels at which different categories of noise (impulsive or non-impulsive) have the potential to injure (Level A harassment pursuant to the MMPA) or the potential to disturb (Level B harassment) marine mammals. NMFS Permits Division does not anticipate and is not proposing to authorize any Level A harassment for this project.

The Level B harassment threshold for impulsive sounds is 160 dB re 1 μPa_{RMS} (hereafter, 160 dB), and for non-impulsive (sometimes referred to as "continuous") sounds, it is 125 dB re 1 μPa_{RMS}[2] (hereafter, 125 dB). The POA test pile project includes both impact pile driving, which produces impulsive sounds, and vibratory pile driving, which produces non-impulsive sounds, above these harassment criterion levels. Thus, project-related pile driving could result in Level B harassment of marine mammals, which we are considering equivalent to ESA non-lethal (disturbance) take for the purpose of this biological opinion.

[2] Typically, the Level B harassment threshold for non-impulsive sound is considered to be 120 dB, but at this location, measured ambient sound due to tidal exchange through a narrow section of Cook Inlet has been found to often reach or exceed 125 dB.

Proposed Mitigation Measures

The POA prepared a Marine Mammal Monitoring and Mitigation Plan (4MP), received by AKR on February 2, 2016, which is presented as an attachment to this Opinion and would be implemented during all pile driving activity. Mitigation measures presented in the proposed IHA (NMFS 2015b) are summarized below. Technical aspects of the ensonified area are further explained and discussed in Section 6. **The mitigation measures below and in the attached 4MP are, verbatim, those proposed by the applicant. Certain of these mitigation measures were determined by AKR to be insufficient in minimizing take of belugas or were imprecise in their description. Therefore AKR has augmented these mitigation measures with the Terms and Conditions in the ITS appended to this Biological Opinion.**

(a) *Protected species observers (PSOs)* -- POA will collect sighting data and behavioral responses of marine mammal species observed in the region of activity that is likely due to construction. Four PSOs will work concurrently in rotating shifts to provide full coverage for marine mammal monitoring during in-water pile installation activities for the Test Pile Program.

(b) Work will occur only during daylight hours, when visual monitoring of marine mammals can be conducted.

(c) *Disturbance (Harassment) Zones or Zones of Influence*—Disturbance zones, harassment zones, or zones of influence (ZOI) (also referred to as ensonified areas) are the areas in which sound levels equal or exceed 160 dB for impact driving and 125 dB for vibratory driving. Note that 125 dB has been established as the Level B harassment zone isopleth for vibratory driving since ambient noise levels near the POA are frequently above 120 dB (see Section 6.1 for further discussion). Nominal radial distances proposed in the IHA for unattenuated Level B harassment zones are: 1,359 m for impact pile driving and 3,981 m for vibratory driving. These (rounded to 1.4 km and 4.0 km) are the radii of the 160 dB and 125 dB zones, respectively (80 FR 78176).

(d) *Soft Start*—The use of a soft start procedure is believed to provide additional protection to marine mammals by warning nearby marine mammals of impending noise and providing a chance to leave the area prior to the hammer operating at full capacity. Soft start will be required at the beginning of each day or work shift and at any time following a cessation of pile driving of 20 minutes or longer. POA will initiate sound from vibratory hammers for fifteen seconds at reduced energy followed by a 1 minute waiting period, with the procedure repeated two additional times[3]. For impact driving, the IHA proposes an initial set of three strikes from the impact hammer at reduced energy, followed by a thirty-second waiting period, then two subsequent three strike sets (80 FR 78176).

(e) *Shut-down Zone* – **Note: This proposed mitigation measure has been changed as indicated in the ITS appended to this opinion (see Section 11.1for further explanation).**

[3] In the event that soft starts of vibratory hammers prove unsafe or impossible, the applicant will work with AKR to amend this mitigation measure.

The POA will monitor a 100-meter "shutdown" zone during all pile-driving operations (vibratory and impact) to prevent Level A take by injury. PSOs will begin observing for marine mammals within the harassment zones for 20 minutes before "the soft start" begins. If a marine mammal(s) is present within the 100-meter shutdown zone prior to the "soft start" or if marine mammal occurs during "soft start" pile driving will be delayed until the animal(s) leaves the 100-meter shutdown zone. Pile driving will resume only after the PSOs have determined (through sighting or by waiting 20 minutes) that the animal(s) has moved outside the 100-meter shutdown zone. Additionally, the IHA proposal indicates that pile driving operations will shut down if a group of five or more beluga whales, or a single calf, is sighted within or approaching the160 dB or 125 dB Level B harassment (disturbance) zones.

(f) Conduct briefings among construction supervisors and crews, marine mammal monitoring team, and POA staff prior to the start of all pile driving activity, and when new personnel join the work, to explain responsibilities, communication procedures, marine mammal monitoring protocol, and operational procedures.

(g) If a marine mammal comes within 10 m of any in-water project-related work other than pile driving (*e.g.*, standard barges, tug boats, barge-mounted excavators, or clamshell equipment used to place or remove material), operations shall cease and vessels shall reduce speed to the minimum level required to maintain steerage and safe working conditions. This type of work could include the following activities: (1) Movement of the barge to the pile location or (2) positioning of the pile on the substrate via a crane (*i.e.*, stabbing the pile).

2.2. Action Area

"Action area" means all areas to be affected directly or indirectly by the Federal action and not merely the immediate area involved in the action (50 CFR 402.02). For this reason, the action area is typically larger than the project area and extends out to a point where no measurable effects from the proposed action occur.

The Port of Anchorage is located in the industrial waterfront of Anchorage, just south of Cairn Point and north of Ship Creek (Latitude 61° 15' N, Longitude 149° 52' W). Anchorage is located where Knik Arm and Turnagain Arm, the two branches of upper Cook Inlet, join. We define the action area for this consultation to include the maximum area within which project-related noise levels are expected to ever reach or exceed 125 dB re 1 μPa $_{RMS}$ (henceforth 125 dB), and are expected to approach ambient noise levels (where no measureable effect from the project would occur). For this action, the action area includes all marine waters within 4 km of any pile driven as part of the Port of Anchorage Test Pile Project.

3.0. APPROACH TO THE ASSESSMENT

We will use the following approach to determine whether the proposed action described in Section 2.1 is likely to jeopardize listed species or destroy or adversely modify critical habitat:

- *Identify those aspects (or stressors) of the proposed action that are likely to have direct and indirect effects* on the physical, chemical, and biotic environment of the

project area. As part of this step, we identify the action area – the spatial and temporal extent of these direct and indirect effects.

- *Identify the rangewide status of the species and critical habitat* likely to be adversely affected by the proposed action. This section describes the current status of each listed species and its critical habitat relative to the conditions needed for recovery. We determine the rangewide status of critical habitat by examining the condition of its physical or biological features (also called "primary constituent elements" or PCEs in some designations) - which were identified when the critical habitat was designated. Species and critical habitat status are discussed in Section 4.

- *Describe the environmental baseline* in the action area, including: past and present impacts of Federal, state, or private actions and other human activities *in the action area*; anticipated impacts of proposed Federal projects that have already undergone formal or early section 7 consultation, and the impacts of state or private actions that are contemporaneous with the consultation in process. The environmental baseline is discussed in Section 5 of this opinion.

- *Analyze the effects of the proposed actions* - Identify the listed species that are likely to co-occur with these effects in space and time and the nature of that co-occurrence (these represent our *exposure analyses*). In this step of our analyses, we try to identify the number, age (or life stage), and gender of the individuals that are likely to be exposed to stressors and the populations or subpopulations those individuals represent. NMFS also evaluates the proposed action's effects on critical habitat features. The effects of the action are described in Section 6 of this opinion.

- *Describe any cumulative effects* - Cumulative effects, as defined in NMFS's implementing regulations (50 CFR 402.02), are the effects of future state or private activities, not involving Federal activities, that are reasonably certain to occur within the action area. Future Federal actions that are unrelated to the proposed action are not considered because they require separate section 7 consultation. Cumulative effects are considered in Section 7 of this opinion.

- *Integrate and synthesize* the above factors to assess the risk that the proposed action poses to species and critical habitat. In this step, NMFS adds the effects of the action (Section 6) to the environmental baseline (Section 5) and the cumulative effects (Section 7) to assess whether the action could reasonably be expected to: (1) appreciably reduce the likelihood of both survival and recovery of the species in the wild by reducing its numbers, reproduction, or distribution; or (2) reduce the value of designated or proposed critical habitat for the conservation of the species. These assessments are made in full consideration of the status of the species and critical habitat (Section 4). Integration and synthesis with risk analyses occurs in Section 8 of this opinion.

- *Reach conclusions* - Conclusions regarding jeopardy and the destruction or

adverse modification of critical habitat are presented in Section 9. These conclusions flow from the logic and rationale presented in the Integration and Synthesis Section 8.

4.0. RANGEWIDE STATUS OF THE SPECIES AND CRITICAL HABITAT

4.1. Species Addressed in this Opinion

In their request for consultation, the action agencies originally determined that the only ESA-listed species to be affected by this project is endangered Cook Inlet beluga whale. However, the endangered western distinct population segment (wDPS) of Steller sea lion is included in NMFS's IHA proposal (80 FR 78176). Therefore this opinion will include analysis of potential effects to both wDPS Steller sea lion and Cook Inlet beluga whales. The action area includes critical habitat for Cook Inlet belugas (although the immediate port area has been excluded from critical habitat – see Figure 1), but does not include Steller sea lion critical habitat. The Permits Division and the Corps determined that this action will have no effect on designated critical habitat for either Cook Inlet beluga whales or Steller sea lions, so effects to critical habitat will not be evaluated in this opinion.

4.2. Cook Inlet Beluga Whale

4.2.1. Description and Status

The beluga is a small, toothed (Odontocete) whale in the family Monodontidae, a family shared with only the narwhal. Beluga calves are born dark to brownish gray and lighten to white or yellow-white with age. Adult Cook Inlet beluga whales average between 3.6-4 m (12-14 ft.) in length.

The Cook Inlet beluga whale Distinct Population Segment (DPS), one of five beluga whale stocks in Alaska, is genetically distinct from other Alaska populations suggesting the Alaska Peninsula is an effective barrier to genetic exchange (O'Corry-Crowe *et al.* 1997) and that these whales may have been separated from other stocks at least since the last ice age. There is no indication that these whales make forays into the Bering Sea where they might intermix with other Alaskan stocks.

Originally estimated at 1,300 whales in 1979 (Calkins 1989), Cook Inlet belugas experienced a dramatic decline in the 1990s. The 47 percent decline between 1994 and 1998 was contemporaneous with unsustainable levels of subsistence harvest. However, the population failed to show signs of recovery following a moratorium on subsistence harvest. NMFS listed the population as "depleted" in 2000 as a consequence of the decline, and as "endangered" under the Endangered Species Act in 2008. Population estimates from 1999 through 2014 are shown in Table 1.

Table 1. Cook Inlet beluga population estimates, 1999-2014

Year														
1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2014
367	435	386	313	357	366	278	302	375	375	321	340	284	312	340

Sources: Allen and Angliss 2014; Hobbs and Shelden 2008; Hobbs *et al*. 2000 2009, 2011, 2012; Rugh *et al*. 2003, 2004a, 2004b, 2005a,b,c, 2006a,b,c, 2007; Shelden *et al*.2013, 2014, 2015.

In April 2011, NMFS designated two areas of critical habitat for Cook Inlet beluga whales. The designation encompasses 7,800 km^2 (3,013 mi^2) of marine and estuarine habitat in Cook Inlet, including approximately 1,909 km^2 (738 mi^2) in critical habitat area 1 and 5,891 km^2 (2,275 mi^2) in critical habitat area 2 (Figure 1). The Port of Anchorage, the adjacent navigation channel, and the turning basin were excluded from critical habitat designation due to national security concerns (76 FR 20180).

4.2.2. Habitat Use, Foraging Ecology and Behavior

Although beluga whales remain year-round in Cook Inlet, they demonstrate seasonal movements within the inlet. During the summer and fall, beluga whales are concentrated near the Susitna River mouth, Knik Arm, Turnagain Arm, and Chickaloon Bay (Nemeth *et al.* 2007). During the winter, beluga whales concentrate in deeper waters in the mid-inlet to Kalgin Island, and in the shallow waters along the west shore of Cook Inlet to Kamishak Bay. Some whales may also winter in and near Kachemak Bay. Recent observations indicate large pods (up to 200-300 animals) using waters along the western side of Cook Inlet north of West Foreland during December and January (S. Callaway, pers. comm. 01/19/2016).

Belugas in Cook Inlet appear to feed extensively on concentrations of spawning eulachon in the spring, then shift to foraging on salmon species as eulachon runs diminish and salmon return to spawning streams. From late spring and throughout summer, most sampled beluga whale stomachs contained Pacific salmon (Calkins 1989). Spring and summer feeding in upper Cook Inlet, principally on fat-rich fish such as salmon and eulachon, is important to the energetics of these animals. In the fall, as anadromous fish runs begin to decline, beluga whales consume fish species found in nearshore bays and estuaries (cod and bottom fish). Dive data from belugas tagged with satellite transmitters suggest whales feed in deeper waters during winter (Hobbs *et al*. 2005).

Beluga whales are highly gregarious and often interact in close, dense groups. Groups of 10 to more than 100 whales have been observed in Cook Inlet. Most calving in Cook Inlet is assumed to occur from mid-May to mid-July (Calkins 1984; NMFS unpublished data).Young beluga whales are nursed for two years and may continue to associate with their mothers for a considerable time thereafter (Reeves *et al.* 2002). Although calves likely remain with their mothers until adulthood, adults often appear to be segregated by sex (Norris 1994).

A number of studies have been conducted on the distribution of beluga whales in upper Cook Inlet including NMFS aerial surveys, NMFS data from satellite-tagged belugas (Hobbs *et al.* 2011), opportunistic sightings, baseline studies conducted for the Knik Arm Bridge and Toll Authority (KABATA) (Funk *et al.* 2005) and Seward Highway improvements (Markowitz *et al.* 2007), passive acoustic monitoring surveys throughout Cook Inlet (Lammers *et al.* 2013), JBER observations conducted within Eagle Bay and Eagle River (U.S. Army Garrison Fort Richardson 2009), and the scientific and construction monitoring program at the POA (Cornick and Pinney 2011, Cornick and Saxon-Kendall 2008, 2009; Cornick *et al.* 2010, Cornick *et al.* 2011; ICRC 2009a, 2009b, 2010, 2011, 2012; Markowitz *et al.* 2007; Prevel-Ramos *et al.* 2006). These data document the distribution and occurrence of beluga whales in upper Cook Inlet,

particularly in lower Knik Arm and the project area.

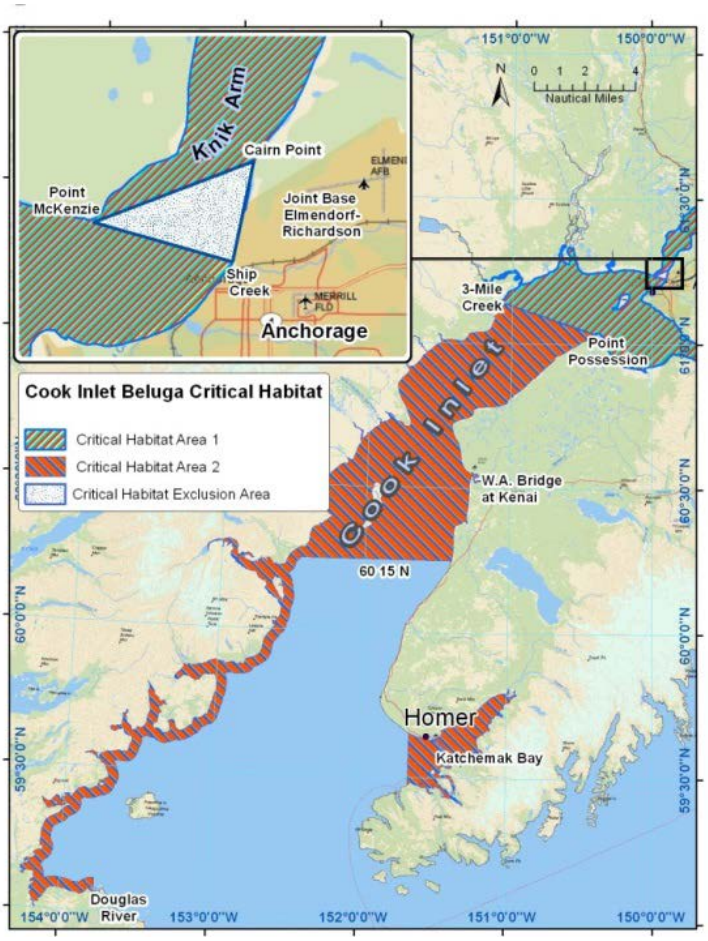
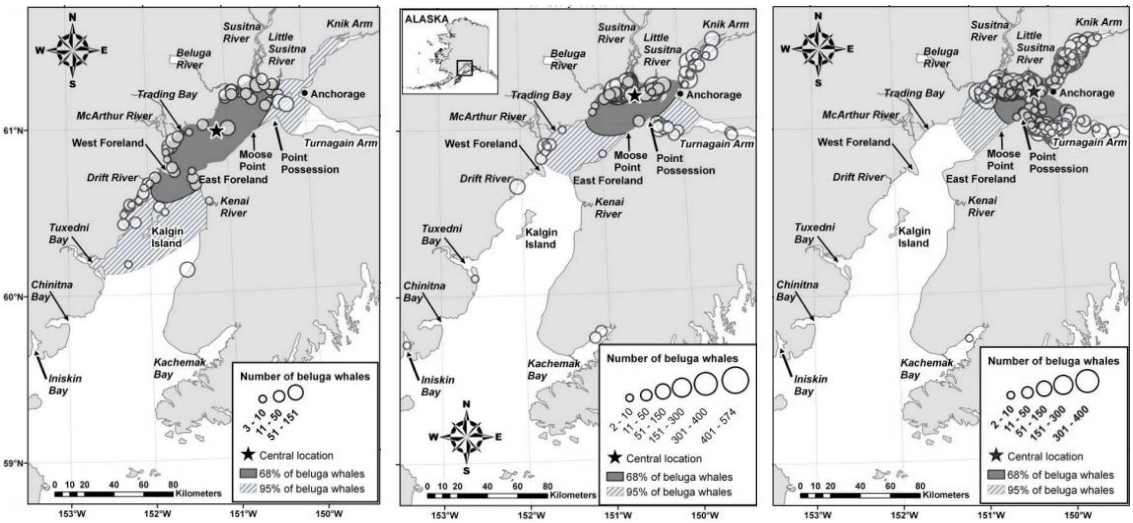


Figure 1. Critical habitat for the Cook Inlet beluga whale

From an examination of aerial survey data, Rugh *et al.* (2010) noted that the spring-summer distribution patterns of belugas in Cook Inlet showed marked changes over 30 years. In 1978 and 1979 belugas were distributed over a relatively large area, with the highest concentrations from Drift River to the Susitna Delta (Figure 2A). Traditional Ecological Knowledge also indicated that Cook Inlet belugas had long been observed in the lower Inlet, including Kachemak Bay on the eastern side and Tuxedni and Trading Bays on the western side (NMFS 2015a).

From 1993 to 1997, the area of highest summer concentration contracted to a region north of Moose Point (Figure 2B). During the 1998 to 2008 period, the area of highest concentration encompassed only Knik Arm and Chickaloon Bay (Figure 2C). Core summer distribution was estimated to have contracted from over 7,000 km^2 (2,703 mi^2) in 1978/1979, to 2,800 km^2 (1,081 mi^2) in 1998/2008 (Rugh *et al.* 2010). Fewer sightings of CI belugas the lower Inlet in recent decades (Hansen and Hubbard 1999; Speckman and Piatt 2000; Rugh et al. 2000, 2004, 2010) indicate that the summer range of Cook Inlet belugas has contracted to the mid and upper Inlet, coincident with their decline in population size.



A. June- July 1977 / 1978 B. June- July 1993 / 1997 C. June- July 1998 / 2008

Figure 2. Range contraction of beluga whales in Cook Inlet from 1978 to 2008 (Source: NMFS 2015a and Rugh 2010).

A recent review of beluga presence data from aerial surveys, satellite-tagging, and opportunistic sightings (Shelden *et al.* in press), indicates that the range has contracted "remarkably" since the 1990s. Almost the entire population is found in only northern waters from late spring through the summer and into the fall. This differs starkly from surveys in the 1970s when whales were found in or would disperse to the lower inlet by midsummer. Shelden *et al.* (in press) conclude that the beluga whale population appears to now be consolidated into preferred habitat in the upper-most reaches of Cook Inlet.

Beluga whales are observed most often in the POA area at low tide in the fall, peaking in late August to early September (Markowitz and McGuire 2007; Cornick and Saxon-Kendall 2008). Although the POA scientific monitoring studies indicate that the area is not used frequently by many beluga whales, individuals and sometimes large groups of beluga whales have been observed passing through the area when traveling between lower and upper Knik Arm. Diving and traveling have been the most common behaviors observed, with many instances of confirmed feeding (including upstream of nearby Ship Creek (Matthew Eagleton, NMFS Pers. Comm. 2015). In all years, beluga whales have been observed to enter the project footprint while construction activities were taking place, including pile driving and dredging. During the POA sheet pile driving operation from 2009 through 2011, as many as 23 beluga whales were observed at one time within the designated 160 dB harassment zones. No significant behavioral changes or reactions to in-water construction activities were observed by either the construction crews or scientific observers (Kendall 2010; Cornick *et al.* 2011).

4.2.3. Hearing Ability and Sound Production

Like other odontocete cetaceans, beluga whales produce sounds for two overlapping functions: communication and echolocation. For their social interactions, belugas emit communication calls with an average frequency range of about 0.2 to 7.0 kHz (Garland *et al.* 2015), (well within the human hearing range), and the variety of audible whistles, squeals, clucks, mews, chirps, trills, and bell-like tones they produce have led to their

nickname as sea canaries (ADFG 2015). At the other end of their hearing range, belugas use echolocation signals (biosonar) with peak frequencies at 40-120 kHz (Au, 2000) to navigate and hunt in dark or turbid waters, where vision is limited. Belugas and other odontocetes make sounds across some of the widest frequency bands that have been measured in any animal group. Beluga whales are one of five non-human mammal species for which there is convincing evidence of frequency modulated vocal learning (Tyack 1999).

Similar to other odontocetes, belugas have a "U-shaped" audiogram, with high sensitivities between about 30 kHz to just over 100 kHz (Awbrey *et al*. 1988, Klishin *et al*. 2000, Finneran *et al*. 2005). Most of previous studies measured beluga hearing in very quiet conditions. However, in Cook Inlet tidal currents regularly produce ambient sound levels well above 100 dB (Lammers *et al.* 2013). In the first report of hearing ranges of belugas in the wild, results of Castellote *et al.* (2014) were similar to those reported for captive belugas, with most acute hearing at middle frequencies, about 10-75 kHz (Figure 3). Beluga whales conduct echolocation at relatively high frequencies, where their hearing is most sensitive, and communicate at frequencies where their hearing sensitivity overlaps that of humans. Ridgway *et al*. (2001) measured hearing thresholds at various depths down to 984 ft (298 m) at frequencies between 500 Hz and 100 kHz and found that beluga whales showed unchanged hearing sensitivity at any measured depth.

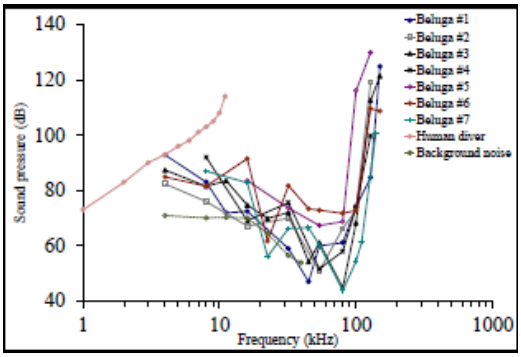


Figure **3.** Audiograms of seven wild beluga whales; human diver audiogram and Bristol Bay background noise for comparison (from Castellote *et al.* 2014).

4.3. Steller Sea Lions

Steller sea lions have been reported from the action area, but in very low numbers, and often no animals reported in a given year. As with Cook Inlet beluga whales, we focus in this opinion on aspects of wDPS Steller sea lion ecology that are relevant to the effects of this project.

4.3.1. Description and Status

Steller sea lions belong to the family Otariidae, which includes fur seals (*Callorhinus ursinus*). Steller sea lions are the largest otariid and show marked sexual dimorphism with males 2-3 times larger than females. On average, adult males weigh 566 kg (1,248 lbs.) and adult females are much smaller, weighing on average 263 kg (580 lbs.; Fiscus 1961; Calkins and Pitcher 1982; Winship *et al*. 2001).

Following declines of 63% on certain rookeries since 1985, and declines of 82% since 1960, the Steller sea lion was listed as a threatened species under the ESA on November 26, 1990 (55 FR 49204). In 1997, NMFS reclassified Steller sea lions as two DPSs based on genetic studies and other information (62 FR 24345). At that time, the eastern DPS was listed as threatened, and the wDPS was listed as endangered. On November 4, 2013, the eastern DPS was removed from the endangered species list (78 FR 66139). Information on Steller sea lion biology, threats, and habitat (including critical habitat) is available online at: http://alaskafisheries.noaa.gov/protectedresources/stellers/default.htm, and in the revised Steller Sea Lion Recovery Plan (NMFS 2008a), which can be accessed at: http://alaskafisheries.noaa.gov/protectedresources/stellers/recovery/sslrpfinalrev030408.pdf

The 2014 Stock Assessment Report for the wDPS of Steller sea lions indicates an abundance estimate of 79,300 individuals in this stock, a figure derived from surveys of Russia and the U.S. combined (Allen and Angliss 2014). The minimum population estimate for the U.S. portion of this stock (from the aggregate total of 2008-2012 counts) is 45,659 adults and pups (Allen and Angliss 2014). The population trend of wDPS Steller sea lions from 2000-2012 varies regionally, from -7.23 percent per year in the Western Aleutians to 4.51 percent per year in the eastern Gulf of Alaska. Overall, the wDPS Steller sea lion population was estimated to be increasing at about 1.67 percent per year from 2000-2012 (Allen and Angliss 2014).

4.3.2. Range and Distribution in Action Area

The range of the Steller sea lion extends across the rim of the North Pacific Ocean, from northern Japan, the Kuril Islands and the Okhotsk Sea, through the Aleutian Islands and Bering Sea, along Alaska's southern coast, and as far south as the California Channel Islands (NMFS 2008c). The eastern DPS includes sea lions born on rookeries from California north through Southeast Alaska; the western DPS includes those animals born on rookeries from Prince William Sound westward, with an eastern boundary set at 144°W (Figure 4).

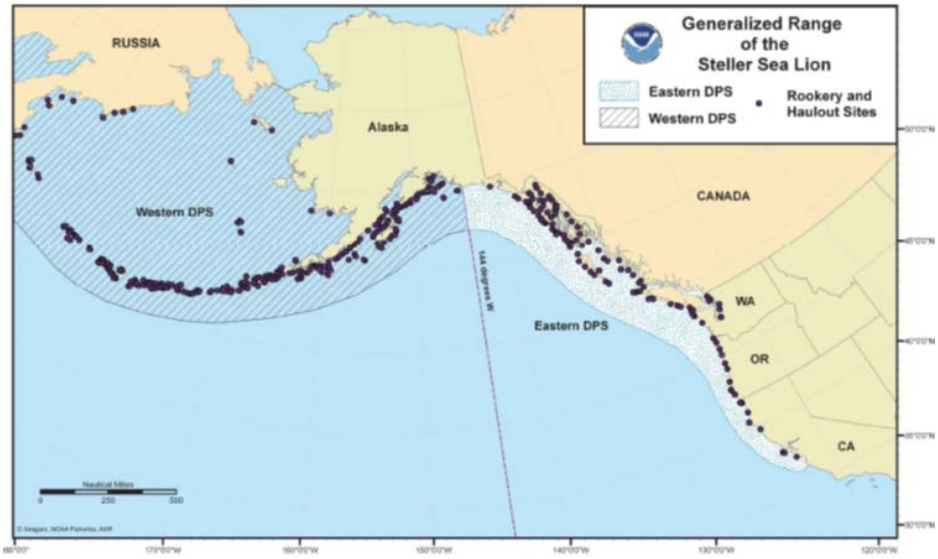


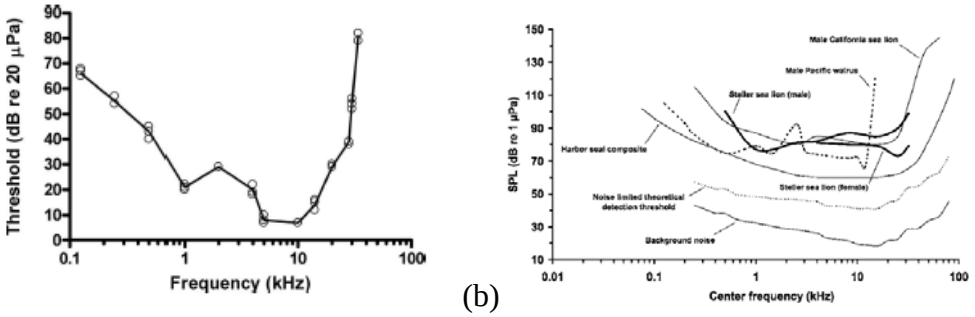
Figure 4. Range of the Steller sea lion.

In appendices to their surveys of Cook Inlet belugas, Rugh *et al.* (2005a,b) and Shelden *et al.* (2013) noted counts of Steller sea lions in lower Cook Inlet, with concentrations on Elizabeth Island, Shaw Island, Akumwarvik Bay and Iniskin to Chinitna Bays. The closest of these locations to the project action area is over 110 miles (177 km) to the south. Steller sea lion haulouts do not occur in upper Cook Inlet, and Steller sea lions are rarely observed in the action area vicinity. Although opportunistic sightings reported to NMFS have sporadically documented single Steller sea lions in Knik or Turnagain Arms, these are likely the occasional individual animal wandering into Cook Inlet river mouths during spring and summer periods to seek seasonal runs of salmon or eulachon. It is rare for Steller sea lions to be encountered in upper Cook Inlet. Steller sea lions have not been documented in upper Cook Inlet during beluga whale aerial surveys conducted annually in June from 1994 through 2012 (Shelden *et al.* 2013). During construction monitoring in June of 2009, a Steller sea lion was documented three times (within the same day) at the POA and was believed to be the same individual each time (ICRC 2009a). The Port of Anchorage notes that:

> "Alaska marine waters, including Cook Inlet, are undergoing environmental changes that are correlated with changes in movements of animals, including marine mammals, into expanded or contracted ranges. For example, harbor seals and harbor porpoises are increasing in numbers in Upper Cook Inlet. It is unknown at this time what the impacts of environmental change will be on Steller sea lion movements, but it is possible that Steller sea lions may be sighted more frequently in Upper Cook Inlet, which is generally considered outside their typical range. The Steller sea lions sightings at the POA in 2009 indicate that this species can and does occur in Upper Cook Inlet."

4.3.3. Hearing Ability

In-air and underwater hearing of Steller sea lions is similar to that of other otariids, ranging from hundreds of Hz to less than 100 kHz. (Muslow and Reichmuth 2010, Kastelein *et al.* 2005, Reichmuth and Southall 2011) (Figure 5).



(a) (b)

Figure 5. Underwater and aerial audiograms for Steller sea lions: (a) Muslow and Reichmuth (2010) for juvenile, aerial; (b) Kastelein *et al*. 2005 for adult male and female, underwater [audiograms of harbor seal, California sea lion and walrus for comparison].

4.3.4. Steller Sea Lion Critical Habitat

Steller sea lion critical habitat (Figure 6) includes a 20 nautical mile buffer around all

major haulouts and rookeries, as well as associated terrestrial, air and aquatic zones, and three large offshore foraging areas. The proposed project is located well outside Steller sea lion critical habitat, and there are no known haul-outs or rookeries in the action area.

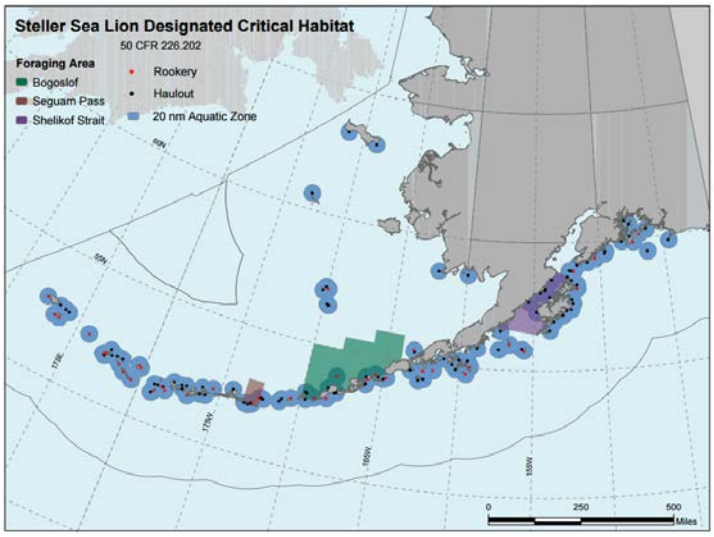


Figure 6. Designated critical habitat for Steller sea lions

5.0. ENVIRONMENTAL BASELINE

The environmental baseline for biological opinions includes the past and present impacts of all state, Federal, or private actions and other human activities in the action area, the anticipated impacts from all proposed Federal projects in the action area that have already undergone formal or early section 7 consultation, and the impact of state or private actions that are contemporaneous with the consultation in process (50 CFR §402.02). The environmental baseline for this opinion includes a review of activities that affect the survival and recovery of threatened and endangered species and designated critical habitat in the action area.

This section focuses primarily on existing ongoing activities that may affect Cook Inlet beluga whales, and any Steller sea lions in the action area. Although some of the activities discussed below are outside the action area, they may still have an influence on these species or their habitat in the action area.

Cook Inlet beluga whales may be impacted by a number of anthropogenic activities present in upper and mid-Cook Inlet. Over 61 percent of Alaska's human population (735,601) resides within southcentral Alaska or the Cook Inlet region. The Alaska Department of Labor and Workforce Development 2014 population estimate for the Municipality of Anchorage was 298,908, for the Matanuska-Susitna Borough was 100,178 and for the Kenai Peninsula Borough was 57,763 (ADLWD 2015). The high degree of human activity, especially within upper Cook Inlet, has produced a number of anthropogenic risk factors that marine mammals must contend with, including: coastal and marine development, ship strikes, noise pollution, water pollution, prey reduction, direct mortalities, and research-induced harassment, harm and mortality, in addition to factors operating on a larger scale such as predation, disease, and climate change. The species may be affected by multiple threats at any given time, compounding the impacts

of the individual threats (NMFS 1991; 2008b, 2015b). Anthropogenic risk factors are discussed individually below.

5.1. Coastal Development

Beluga whales use nearshore environments to rest, feed, and breed, and thus could be affected by any coastal development that impacts these activities. Coastline development can lead to both direct habitat loss from construction of roads, housing or other shoreline developments, and indirect loss associated with bridges, boat traffic, in-water noise, and discharges that affect water quality. For the most part, the Cook Inlet shoreline is undeveloped, but there are a number of port facilities, airports, housing developments, wastewater treatment plants, roads, and railroads that occur along or close to the shoreline. Knik Arm supports the largest port and military base in the state, and there are numerous offshore oil and gas platforms ranging between the Forelands to just north of Tyonek. Construction noise in Cook Inlet is associated with activities such as dredging and pile driving.

5.1.1. Port Facilities

Port facilities in Cook Inlet are found at Anchorage, Point Mackenzie, Nikiski, Kenai, Homer, Seldovia, and Port Graham; barge landings are present at Tyonek, Drift River, and Anchor Point.

The Port of Anchorage is Alaska's largest seaport and provides 90 percent of the consumer goods for the state. It includes three cargo terminals, two petroleum terminals, one dry barge berth, two railway spurs, and a floating dock for small watercraft. About 450 ships or tug/barges call at the POA each year. Operations began at the POA in 1961 with a single berth. Since then, the POA has expanded to a terminal that moves more than four million tons of material across its docks each year (POA 2009). This existing 129-acre Port facility is operating at or above sustainable practicable capacity. The existing infrastructure and support facilities are substantially past their design life and have degraded to levels of marginal safety, especially regarding seismic design criteria.

Maintenance dredging at the POA began in 1965, and is an ongoing activity from May through November in most years, affecting about 100 acres of substrate per year. Dredging at the POA does not seem to be a source of re-suspended contaminants (USACE 2005, 2008).

Port MacKenzie is along western lower Knik Arm and development began in 2000 with the construction of a barge dock. Additional construction has occurred since then and Port MacKenzie currently consists of a 152 m (500 ft.) bulkhead barge dock, a 366 m (1,200 ft.) deep draft dock with a conveyor system, a landing ramp, and more than 8,000 acres of adjacent uplands. Current operations at Port MacKenzie include dry bulk cargo movement and storage. A bulkhead rupture during 2015 has necessitated replacement of sheet piles across much of its seaward boundary.

The Drift River facility in Redoubt Bay is used primarily as a loading platform for shipments of crude oil. The docking facility there is connected to a shore-side tank farm and designed to accommodate tankers in the 150,000 deadweight-ton class. In 2009, a volcanic eruption forced the evacuation of the terminal and an eventual draw-down of

stored oil. Hilcorp Alaska bought the facility in 2012 and after numerous improvements partially reopened the facility to oil storage and tanker loading operations.

Nikiski is home to several privately owned docks. Activity at Nikiski includes the shipping and receiving of anhydrous ammonia, dry bulk urea, liquefied natural gas, sulfuric acid, petroleum products, caustic soda, and crude oil. In 2014, the Arctic Slope Regional Corporation expanded and updated its rig tenders dock in Nikiski, in anticipation of increased oil and gas activity in Cook Inlet and to serve activities in the Chukchi and Beaufort seas.

Ladd Landing Beach, located on the western shore of Cook Inlet near Tyonek, serves as public access to the Three Mile Subdivision, and as a staging area for various commercial fishing sites in the area.

5.2. Oil and Gas Development

Oil and gas development in Cook Inlet provides natural gas to the State's largest population centers. Platforms, pipelines, and tankers represent potential sources of spills. Lease sales for oil and gas development in Cook Inlet began in 1959 (ADNR 2014). Prior to the lease sales, there were attempts at oil exploration along the west side of Cook Inlet. By the late 1960s, 14 offshore oil production facilities were installed in upper Cook Inlet; therefore most Cook Inlet platforms and much of the associated infrastructure is more than 40 years old.

Today, there are 16 platforms in Cook Inlet (ADNR 2015), 12 of which are actively producing oil and gas; four are experiencing varying degrees of inactivity (Figure 6). ADNR (2015) reports 401 active oil and gas leases in Cook Inlet that total approximately 1,126,813 acres of State leased land, (419,454 acres onshore and 707,359 acres offshore). There are no platforms in lower Cook Inlet, which is closer to the area where Steller sea lions occur in any number.

5.3. Ambient Noise and Noise Pollution

Underwater sound levels in Cook Inlet arise from many sources, including physical noise, biological noise, and human-caused noise. Physical noise includes wind, waves at the surface, currents, earthquakes, ice movement, and atmospheric noise (Richardson *et al*. 1995). Biological noise includes sounds produced by marine mammals, fish, and invertebrates. Human-caused noise consists of vessel motor sounds, oil and gas operations, maintenance dredging, aircraft overflights, and construction noise. Ambient sound varies within Cook Inlet. In general, ambient and background noise levels within the action area are assumed to be less than 120 dB whenever conditions are calm, and exceeding 120 dB during storm events and passage of large vessels (Blackwell and Greene 2003; Illingworth and Rodkin 2013). In a memo dated July 27, 2015, HDR/CH2M provided supporting evidence from previous studies indicating that ambient sound in the immediate POA area averages 125 dB, due to frequent tug and barge traffic.

5.3.1. Seismic Activity Noise in Cook Inlet

Seismic surveys use high energy, low frequency sound in short pulse durations to characterize subsurface geology (Richardson *et al*. 1995). Geophysical seismic activity

has been described as one of the loudest human-made underwater noise sources, with the potential to harass or harm marine mammals, including beluga whales.

Figure 6. Oil and gas operations in Cook Inlet
(Source: http://dog.dnr.alaska.gov/GIS/Data/ActivityMaps/CookInlet/CI_ OilandGasActivity _20130724.pdf)

Cook Inlet has a long history of oil and gas activities including seismic exploration, geophysical and geotechnical surveys, exploratory drilling, increased vessel and air traffic, and platform production operation. A seismic program occurred near Anchor Point in the fall of 2005. Geophysical seismic operations were conducted in Cook Inlet during 2007, near Tyonek, East and West Forelands, Anchor Point, and Clam Gulch. Additional small seismic surveys were again conducted in Cook Inlet during 2012. ADNR (2015) notes that as of December 31, 2013 approximately 1300 mi^2 (3,367 km^2) of 3-D and 25,000 line miles (40,000 km) of 2-D seismic line surveys have been conducted in Cook Inlet.

Airguns have a history of use in Cook Inlet for seismic exploration. In the past, large airgun arrays of greater than 3,000 in^3 have been used, which produce source noise levels exceeding 240 dB re 1 μPa $_{RMS}$. However, smaller arrays (440-2,400 in^3) are now being used in Cook Inlet both because of the generally shallow water environment and the increased use of ocean-bottom cable and ocean-bottom node technology.

Recent seismic surveys have used maximum airgun arrays of 1,760 and 2,400 in^3 with source levels of about 237 dB re 1 μPa $_{RMS}$. Shallow water surveys have involved 440, 620, and 880 in^3 arrays with source sound pressure levels less than 230 dB re 1 μPa $_{RMS}$. Measured radii to isopleths for MMPA Level A harm (190 dB for cetaceans and 180 dB for pinnipeds) from these guns have ranged from 50 m (164 ft) to nearly 2 km (1.2 mi), while Level B (160 dB) radii have ranged from 3 to 9.5 km (1.8-5.9 mi).

During over 1,800 hours of seismic activity in 2012, Apache Alaska Corporation (Apache) reported zero takes of either beluga whales or Steller sea lions; although some protected marine mammals were observed within zones ensonified to greater than 120 and 160 dB prior to powering down or shutting down of equipment. The company experienced five delays resulting from clearing the 160 dB harassment zone, seven shutdowns, two power-downs, and one speed and course alteration (Lomac-MacNair *et al.* 2013). In 2014 however, despite implementing a total of 13 shut-downs and 7 ramp up delays for marine mammals, observers recorded a total of 29 takes (12 beluga whales, 6 harbor porpoise, 9 harbor seals, and 2 humpback whales) from noise exposures (25 at ≥160 dB $_{RMS}$ and 4 at ≥180 dB $_{RMS}$ (Lomac-MacNair *et al.* 2013). SAE Exploration conducted up to 777 km^2 (300 mi^2) of 3-D seismic survey in Cook Inlet in 2015 and recorded one beluga level B take, as indicated by their acoustic monitoring system.

5.3.2. Oil and Gas Exploration and Production Noise

Blackwell and Greene (2003) recorded underwater noise produced at Phillips A oil platform at distances ranging from 0.3-19 km (0.2-12 mi) from the source. The highest recorded sound level was 119 dB at a distance of 1.2 km (0.75 mi). These were operating noises from the oil platform, not drilling noise, with frequencies generally below 10 kHz. While much sound energy in this noise fell below the hearing thresholds for beluga whales, some noises between 2-10 kHz were measured as high as 85 dB as far away as 19 km (12 mi) from the source. These frequencies are audible to beluga whales, but do not fall within the whale's most sensitive hearing range. Jack-up drilling rigs with the drilling platform and generators located above the sea surface and with lattice legs with very little surface contact with the water are relatively quiet as compared to drill ships or semi-submersible drill rigs (Richardson *et al.* 1995). Because oil and gas activities do not presently occur in lower Cook Inlet, effects to Steller sea lions are minimal.

5.3.3. Vessel Traffic Noise

Vessel traffic includes large shipping, commercial and support vessels, commercial fishing vessels, and personal water craft. Vessel and air traffic are required for support during oil and gas development. Oil produced on the western side of Cook Inlet is transported by tankers to the refineries on the east side. Refined petroleum products are then shipped elsewhere. Liquid natural gas is also transported via tankers once it is processed (ADNR 2015). Blackwell and Greene (2003) recorded underwater noise produced by both large and small vessels near the POA. Large vessels produced

broadband sounds of 126-149 dB re: 1 μPa at 100 m (328 ft). Continuous noise from ships generally exceeds 120 dB to distances between 500 and 2,000 m (1,640 and 6,562 ft), although noise effects for a fixed point are short term when the vessels are underway.

Blackwell and Greene (2003) observed that beluga whales "did not seem bothered" when travelling slowly within a few meters of the hull and stern of the moored cargo-freight ship *Northern Lights* in the Anchorage harbor area. Ship noise is generally below 2 kHz (Blackwell and Greene (2003), below the most sensitive hearing range of beluga whales.

Some studies have indicated that Steller sea lions generally appear skittish around humans and vessel traffic when hauled out on shore (e.g., Matthews 2000; Kucey and Trites 2006). However, when foraging, Steller sea lions can be very tolerant of noise (e.g. Weise and Harvey 2005).

5.3.4. Aircraft Noise

The airspace above 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. Joint Base Elmendorf Richardson also has a runway near and airspace directly over Knik Arm. Lake Hood and Spenard Lake in Anchorage are heavily used by seaplanes. Other small public runways are found at Birchwood, Goose Bay, Merrill Field, Girdwood, the Kenai Municipal Airport, Ninilchik, Homer, and Seldovia. Drilling projects often involve helicopters and fixed-winged aircraft, and aircraft are used for surveys of natural resources including Cook Inlet beluga whales. Airborne sounds do not transfer well to water because much of the sound is attenuated at the surface or is reflected where angles of incidence are greater than 13°; however, loud aircraft noise can be heard underwater when aircraft are directly overhead and surface conditions are calm (Richardson *et al*. 1995).

Richardson *et al.* (1995) observed that beluga whales in the Beaufort Sea will dive or swim away when low-flying (500 m (1640 ft)) aircraft passed directly above them. However, during the Cook Inlet beluga whale surveys, aircraft flying at approximately 244 m (800 ft.) observed little or no change in swimming direction (Rugh *et al.* 2000). This is probably because beluga whales in Cook Inlet have habituated to routine small aircraft overflights. Beluga whales may be less sensitive to aircraft noise than vessel noise, but individual responses may be variable, and depend on previous experiences, beluga activity at the time of the noise, and noise characteristics.

When hauled out, seals and sea lions may react to aircraft overhead (e.g., Born *et al.* 1999). Response to aircraft from pinnipeds in the water has not been noted. There are no Steller sea lion haulouts in the action area vicinity.

5.3.5. Construction and Dredging Noise

Construction noise in Cook Inlet is associated with activities such as dredging and pile driving. Like large port facilities, small and/or private docks may also use pile driving as a part of their expansions or repairs. Dredging is conducted on an annual basis at POA, but occurs near Anchorage, outside of the action area. Impacts to listed marine mammals can occur from underwater noise associated with underwater pipeline construction, including noise from the use of pipe laying barges, tugs, and support vessels.

5.4. Underwater Installations

Currently in Cook Inlet there are approximately 365 km (227 mi) of undersea pipelines, including 125 km (78 mi) of oil pipelines and 240 km (149 mi) of gas pipelines (ADNR 2015). In 2014, the Trans-Foreland Pipeline Co. LLC (owned by Tesoro Alaska) received approval from State, Federal, and regional agencies to build the Trans-Foreland Pipeline, a 46.7-km (29-mi) long, 20.3-cm (8-in) diameter oil pipeline from the west side of Cook Inlet to the Tesoro refinery at Nikiski and the Nikiski-Kenai Pipeline company tank farm on the east side of Cook Inlet. The pipeline will be used by multiple oil producers in western Cook Inlet, to replace oil transport by tanker from the Drift River Tank farm. Horizontal directional drilling will be used at nearshore locations at the East and West Forelands to install the pipeline.

5.5. Water Quality and Water Pollution

The draft Recovery Plan for the Cook Inlet Beluga Whale (NMFS 2015a) states that exposure to industrial chemicals as well as to natural substances released into the marine environment is a potential health threat for Cook Inlet belugas and their prey. An in-depth review of available information on pollution and contaminants in Cook Inlet is presented in the supplement section IX.F of the draft recovery plan (NMFS 2015a).

Main sources of pollutants found in Cook Inlet likely include the 10 wastewater treatment facilities, stormwater runoff, airport de-icing, and discharge from oil and gas development (Norman 2011). Ballast water discharge from ships is another source of potential pollution as well as potential release of non-indigenous organisms into Cook Inlet. Information and statistics ballast water management in Cook Inlet can be found at: http://reports.nukaresearch.com/Reports/Cook-Inlet-ballast-water/Draft%201/regulations/ Given the amount of oil and gas production and vessel traffic, spills of petroleum products are a source of concern for marine mammals inhabiting Cook Inlet. Research has shown that while cetaceans are capable of detecting oil, they do not seem to avoid it (Geraci 1990).

According to the ADEC oil spills database, oil spills to marine waters consist mostly of harbor and vessel spills, and spills from platform and processing facilities. A reported 477,942 L (126,259 gal from 79 spills) of oil was discharged in the Cook Inlet area since July 1, 2013, primarily from vessels and harbor activities and from exploration and production facilities. Three of the ten largest spills in Alaska during state fiscal year 2014 occurred in Cook Inlet; these included 84,000 gallons of produced water by Hillcorp, Kenai gas field, 9,100 gallons of process water released by the Tesoro API Tank Bypass Spill, and a Flint Hills, Anchorage spill of 4,273 gallons of gasoline (ADEC 2014).

Effects to marine mammals encountering such releases could include death or injury from swimming through oil (skin contact, ingestion of oil, respiratory distress from hydrocarbon vapors), contamination of food sources, or displacement from foraging areas.

5.6. Fisheries

Fishing is a major industry in Alaska. Several fisheries occur in Cook Inlet waters and have varying likelihoods of competing with beluga whales (and to a lesser extent Steller

sea lions) for fish due to gear type, species fished, timing, and fisheries location. Commercial, personal use, recreational, and subsistence fisheries all occur within Cook Inlet.

Potential impacts to the beluga whale from personal use, recreational, and subsistence fishing include operating small watercrafts in the river mouths and shallow waters; these could lead to displacement from important habitat, harassment, prey competition, and ship strikes. In the spring of 2012, a young beluga whale was found dead in an educational subsistence fishing net. While histopathology analysis determined the animal likely drowned in the net, other health issues were documented that may have been a contributing factor (NMFS unpublished data). Other than this recent interaction, NMFS is unaware of any beluga whale mortalities in Cook Inlet due to personal use, recreational, or subsistence fisheries. In general, the overall impacts from personal use, recreational and subsistence fishing on the Cook Inlet beluga population is considered low (NMFS 2015a).

Potential impacts from commercial fishing on Cook Inlet beluga whales include harassment, gear entanglement, ship strikes, reduction in prey, and displacement from important habitat. The likelihood of a lethal incidental take of a beluga whale from commercial fishing is low; however, the likelihood of prey reduction from fisheries and/or other sources substantially impacting the recovery of the Cook Inlet beluga whale population is high (NMFS 2015a). There is strong indication that these whales are dependent on access to relatively dense concentrations of high value prey species throughout the summer months. A significant reduction in the amount of available prey may impact the energetics for Cook Inlet beluga whales and delay recovery.

The potential impact of any type of fishing in Cook Inlet on Steller sea lions is very low due to the rarity of the species in most of the inlet. Where Steller sea lions occur, the most likely effect of fisheries is from removal of prey.

5.7. Direct Mortality

Within the proposed action area there are several potential sources of direct mortality for beluga whales and Steller sea lions, including shooting, strandings, fishery/gear/debris interactions, vessel collisions, predation, and research activities.

5.7.1. Subsistence Harvest

The effect from past subsistence harvests on the Cook Inlet beluga whale population was significant. While a harvest occurred at unknown levels for decades or longer, the subsistence harvest levels increased substantially in the 1980s and 1990s to unsustainable levels. Reported subsistence harvests during 1994-1998 probably account for the stock's decline during that interval. In 1999, beluga whale subsistence harvest did not occur as a result of a voluntary moratorium by the hunters that spring; and Public Law 106-553, which required hunting of Cook Inlet beluga whale for subsistence uses by Alaska Natives be conducted pursuant to a cooperative agreement between NMFS and affected Alaska Native organizations. During 2000-2005, only five Cook Inlet beluga whales were harvested for subsistence purposes. Subsistence hunting for Steller sea lions does not occur in the test pile project vicinity.

5.7.2. Poaching and Illegal Harassment

Due to their distribution within the most densely populated region in Alaska and their approachable nature, the potential for poaching beluga whales in Cook Inlet exists. Although NMFS maintains an enforcement presence in upper Cook Inlet, effective enforcement across such a large area is difficult. No poaching incidents have been confirmed to date, although NMFS Enforcement has investigated several reported incidences of Cook Inlet beluga whale harassment. Hunting of Steller sea lions does not occur in the test pile project vicinity.

5.7.3. Stranding

Live stranding occurs when a marine mammal is found in waters too shallow to swim. Cook Inlet beluga whales are probably predisposed to stranding because they breed, feed, and molt in the shallow waters of upper Cook Inlet where extreme tidal fluctuations occur. Strandings can be intentional (e.g., to avoid killer whale predation), accidental (e.g., chasing prey into shallows then becoming trapped by receding tide), or a result of illness or injury (NMFS 2015b). An estimated 876-953 live beluga strandings and a total of 205 dead beluga beachings have been documented in Cook Inlet from1988 through 2015 (NMFS 2015a, NMFS unpbl. data). Beluga whale stranding events may represent a significant threat to the conservation and recovery of this stock. Stranding of this nature is not applicable to sea lions, which have mobility out of water, although pinniped strandings and mortality resulting from entanglement in fishing gear have been documented (e.g., Swails 2005).

5.7.4. Predation

Killer whales are the only natural predators for beluga whales in Cook Inlet (Allen and Angliss 2014). Beluga whale stranding events have also been correlated with killer whale presence, and Native hunters report that beluga whales intentionally strand themselves in order to escape killer whale predation (Huntington 2000). Prior to 2000, an average of one Cook Inlet beluga whale was killed annually by killer whales, with 18 reported killer whale sightings in upper Cook Inlet during 1985-2002 (Shelden *et al*. 2003). During 2001-2012 only three Cook Inlet beluga whales were reported as preyed upon by killer whales (NMFS unpublished data). This is likely an underestimate, however, as preyed-upon belugas may well sink and go undetected. Killer whale predation has been reported to have a potentially significant impact on the Cook Inlet beluga whale population (Shelden *et al*. 2003). We are unaware of any documented predation of Steller sea lions in Cook Inlet.

5.7.5. Ship Strikes

Cook Inlet beluga whales may be susceptible to ship strike mortality. To date, however, only one whale death, in October 2007, has been attributed to a potential ship strike based on blunt force injuries (NMFS unpublished data). Beluga whales may also be more susceptible to strikes from commercial and recreational fishing vessels since both belugas and fishing activities occur where salmon congregate. A number of beluga whales have been photographed with propeller scars (Maguire and Stephens 2014), suggesting that small vessel ship strikes are not rare, but are often survivable. Small boats, which are becoming more abundant in Cook Inlet, are able to quickly approach and disturb these whales in their preferred shallow coastal habitat. Vessel strikes are not a known source of injury or mortality for Steller sea lions.

5.7.6. Research

Research is a necessary endeavor to assist in the recovery of the Cook Inlet beluga population; however, research activities can also disturb or kill these whales, especially when these activities include animal capture, drawing blood and tissue samples, or attaching tracking devices such as satellite tags. Shortly after a tagging event in 2002, a beluga whale was found dead; its tag had transmitted for only 32 hours. Another two beluga whales transmitted data for less than 48 hours, with similar dive patterns; it was assumed they too had died (NMFS, unpublished data). In 2015, an additional animal that had been tagged by researchers in 2002 washed up dead, with infection at the site of instrument attachment implicated as potentially contributing to the cause of death (Huntington 2016).

Beluga surveys require boats and/or planes, adding to the vessel traffic, noise, and pollution near the action area. Aerial surveys could also potentially disturb Cook Inlet beluga whales, especially where circling low-altitude flights are conducted to obtain accurate group counts. Boat based surveys, such as the photo-identification study, often require the boat to come within close proximity to a whale or whale group, likely increasing noise in the immediate area. Deployment and retrieval of passive acoustic monitoring devices requires a boat, which temporarily increases noise in the immediate area. However, once the instruments are deployed, this type of monitoring is noninvasive.

Although research may have an effect on beluga whales, it is anticipated that research will continue to increase because there are many remaining data gaps on Cook Inlet beluga whale biology and ecology (NMFS 2008a). However, managers are increasingly cautious in permitting only minimally invasive techniques. No dedicated Steller sea lion research occurs in or near the action area because the animals are seen there so infrequently.

5.8. Climate Change

There is widespread consensus within the scientific community that atmospheric temperatures are increasing at an unprecedented rate, a trend that is expected to continue for at least the next several decades (Watson and Albritton 2001, Oreskes 2004 IPCC 2014). There is also consensus within the scientific community that this warming trend will alter current weather patterns and patterns associated with climatic phenomena, including the timing and intensity of extreme events such as heat waves, floods, storms, and wet-dry cycles. Warming of the earth's climate is unequivocal, as is evident from observations of increases in global average air and ocean temperatures, widespread melting of snow and ice and increases in global average sea level (Pachauri and Reisinger 2007).

The Intergovernmental Panel on Climate Change (IPCC) estimated that average global land and sea surface temperature has increased by 0.6°C (±0.2°) since the mid-1800s, with most of the change occurring since 1976. This temperature increase is greater than what would be expected given the range of natural climatic variability recorded over the past 1,000 years (Crowley 2000). The IPCC reviewed computer simulations of the effect of greenhouse gas emissions on observed climate variations that have been recorded in the past and evaluated the influence of natural phenomena such as solar and volcanic

activity. Based on its review, the IPCC concluded that natural phenomena are insufficient to explain the increases in land and sea surface temperature, and that most of the warming observed over the last 50 years is likely to be attributable to human activities (Stocker *et al*. 2013).

Continued greenhouse gas emissions at or above current rates would cause further warming and induce many changes in the global climate system during the 21st century that would very likely be larger than those observed during the 20th century (Watson and Albritton 2001).Climate change is projected to have substantial direct and indirect effects on individuals, populations, species, and the structure and function of marine, coastal, and terrestrial ecosystems in the foreseeable future (Houghton 2001, McCarthy 2001, Parry 2007). Climate change would result in increases in atmospheric temperatures, changes in sea surface temperatures, increased ocean acidity, changes in patterns of precipitation, and changes in sea level (Stocker *et al*. 2013).

The indirect effects of climate change for listed marine mammals would result from changes in the distribution of temperatures suitable for many stages of their life history, the distribution and abundance of prey, and the distribution and abundance of competitors or predators.

The strongest warming is expected in the north, exceeding the estimate for mean global warming by a factor or 3, due in part to the "ice-albedo feedback," whereby as the reflective areas of Arctic ice and snow retreat, the earth absorbs more heat, accentuating the warming (NRC 2012). Climate change is projected to have substantial direct and indirect effects on individuals, populations, species, and the structure and function of marine, coastal, and terrestrial ecosystems in the foreseeable future (NRC 2013).

The effects of climate change could include changes in the distribution of temperatures suitable for rearing young, the distribution and abundance of prey, and the distribution and abundance of competitors or predators.

The climate in Cook Inlet is driven by the Alaska Coastal Current, a low salinity river-like body of water that flows through the Pacific Ocean and along the coast of Alaska with a branch that flows into Cook Inlet (Weingartner *et al*. 2005) 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 (Mantua *et al*. 1997; Zhang *et al*. 1997). Phase changes of the PDO have been correlated with changes in marine ecosystems in the northeast Pacific; warm phases have been accompanied by increased biological productivity in coastal waters off Alaska and decreased productivity off the west coast of Canada and the US, whereas cold phases have been associated with the opposite pattern.

The change in water temperature may in turn affect zooplankton biomass and composition. Plankton is 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) demonstrate 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.

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 (Batten and Mackas 2007), a change the authors suggest was driven by changes in climate. Changes in temperature affect zooplankton abundance, which in turn may influence fish species composition, and hence, the quality and types of fish available for beluga whales.

Similarly, changes in ocean climate are hypothesized to have affected the quantity, quality and accessibility of prey, which in turn may have affected the rates of birth and death of sea lions. Ocean climate changes appear to have created adaptive opportunities for various species that are preyed upon by Steller sea lions. The east-west asymmetry of the oceanic response to climate forcing after 1976-77 is consistent with both the temporal aspect [populations decreased after the late 1970's] and the spatial aspect of the decline [western, but not eastern, sea lion populations decreased](Trites *et al.* 2005). While El Nino events have the potential to affect sea surface temperatures, the effects from the 1998 El Nino warming event in 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 Cook Inlet and its dominance by freshwater input act to buffer these waters from periodic and short-term El Nino events.

The physical environment of Cook Inlet is shifting towards increasingly long ice-free seasons. Alaska has experienced the greatest warming of any region in the United States (Karl *et al*. 2009) and Cook Inlet has experienced a reduction in duration of seasonal sea ice.

Beluga whales seasonally breed and feed in nearshore waters during the summer, but are ice-associated during the remaining part of the year. Ice floes can offer protection from predators and, in some regions, support prey, such as ice-associated cod. Moore and Huntington (2008) suggest that belugas and other ice-associated marine mammals might benefit from warmer climates as areas formerly covered ice would be available to forage. However, given the limited winter prey available in upper Cook Inlet (where ice predominates during winter), less winter ice might not benefit Cook Inlet beluga whales.

The bigger threat of climate change to belugas may not be the direct change in climate, but rather the effect regional warming would have on increased human activity. Less ice would mean increased vessel activity with an associated increase in noise, pollution, and risk of ship strike. Other factors include changing prey composition, increased killer whale predation due to lack of ice refuge, and increased competition with co-predators. Specific to Cook Inlet beluga whales, the greatest climate change risks might be a change salmon and eulachon abundance, and any increase in winter susceptibility to killer whale predation. Also, more rapid melting of glaciers might significantly alter the silt deposition in the Susitna Delta, potentially altering habitat for prey (NMFS 2008b). However, the magnitude of these potential effects is unpredictable, and the isolation of beluga whales within Cook Inlet since the last ice age suggests a strong resilience to environmental changes.

At this time, however, available data are insufficient to assess effects (if any exist) from climate change on Cook Inlet beluga whale distribution, abundance, survival or recovery. Because an insignificant proportion of western DPS Steller sea lions make use of Cook Inlet, effects of climate change on the Cook Inlet region are not expected to have measurable population-level effects on this species.

Because wDPS Steller sea lions have only been observed in Upper Cook Inlet during one summer since the 1980s (three observations of an individual animal in 2009), it is difficult to project with confidence what the effects of climate change may be on the distribution of this species in these waters.

6.0. EFFECTS OF THE ACTION

Effects of a proposed action are defined at 50 CFR 402.02 as: "…the direct and indirect effects of an action on the species or habitat, together with the effects of other activities that are interrelated or interdependent with that action, that will be added to the environmental baseline." The types of effects to be analyzed include:

- Direct Effects – Those immediate effects caused by the proposed action and occurring concurrently with the proposed action;

- Indirect Effects – Those effects that are caused by the proposed action and are later in time but still are reasonably certain to occur;

- Cumulative Effects – As defined in the ESA, cumulative effects are future state, tribal, local, or private activities, not involving Federal activities, which are reasonably certain to occur within the action area of the proposed action;

- Interrelated Actions – Those actions that are a part of a larger action and depend on the larger action for justification; and

- Interdependent Actions – Those actions that have no independent utility apart from the action under consideration.

The proposed POA Test Pile Project activities are interrelated with future development of the APMP. However, all effects of the larger APMP will be evaluated independently under the ESA and MMPA and therefore are not a part of this action. The results of the test pile project (the subject of the current consultation) are designed to inform and minimize impacts to the marine environment associated with future development of the APMP. No interdependent actions have been identified.

6.1. Direct Acoustic Effects of Pile Driving

The primary concern associated with the impacts of the proposed action to Cook Inlet beluga whales and wDPS Steller sea lions is effects due to noise associated with pile driving. There remains uncertainty about the potential impacts of sound on marine mammals, on the factors that determine response and effects, and especially on the long-term cumulative consequences from increasing noise in the world's oceans from multiple sources (NRC 2005). Take, as defined by the ESA, may occur, if exposure to anthropogenic sounds affects an individual's stress levels, energetics, or reproduction.

As stated above in Section 2.1.2, since 1997, NMFS has used generic sound exposure thresholds to determine whether an activity that produces underwater and in-air sounds might result in impacts to marine mammals (70 FR 1871). NMFS is currently developing comprehensive guidance on sound levels likely to cause injury and behavioral disruption to marine mammals. However, until formal guidance is available, NMFS uses conservative thresholds of sound pressure levels from broad band sounds that cause behavioral disturbance (160 dB for impulse sound and 120 dB for continuous sound) and injury (180 dB for whales and 190 dB for pinnipeds). These "disturbance" and "injury" thresholds correlate with the "Level A" injury and "Level B" harassment thresholds as those terms are defined pursuant to the MMPA (16 U.S.C. § 1362(18)(A)(i) and (ii)).

As mentioned in Section 5.3, background noise levels in much of the POA action area can remain below 120 dB during calm conditions but rise above 120 dB during ice movement, storm events or during passage of large vessels. The applicant provided justification, based on previous measurements of ambient underwater sound in the Port vicinity, that ambient sound in the area should be considered 125 dB (HDR/CH2M in litt; Blackwell 2005; SFS 2009; URS 2007). This information was reviewed and accepted, based on natural sounds of extreme tidal fluctuations, storms and ice movements, as well as the frequency of barge and other vessel traffic in the Port area. In light of this information, the MMPA "Level B" threshold for harassment is considered to be 125 dB for the Port of Anchorage Test Pile project.

Potential acoustic effects of high levels of underwater sound generated by pile driving could include masking, behavioral responses, and hearing impairment. These effects are considered below.

6.1.1. Masking

The concept of acoustic interference is familiar to anyone who has tried to have a conversation in a noisy restaurant or at a rock concert. In such situations, the collective noise from many sources can interfere with one's ability to understand, recognize, or even detect sounds of interest. Masking from chronic anthropogenic noise sources may disrupt marine mammal communication when industrial sound frequencies overlap communication frequencies used by marine mammals. Studies have shown that cetaceans' response may be similar to that of humans speaking louder to communicate in a noisy situation. Holt *et al*. (2009) found that Southern Resident killer whales in Puget Sound near Seattle increased their call amplitude by 1dB for every 1dB increase in background noise levels.

For their social interactions, belugas emit communication calls with an average frequency range of about 0.2 to 7.0 kHz (Garland *et al.* 2015), and use echolocation signals (biosonar) with peak frequencies at 40-120 kHz (Au 2000). Pile driving typically produces sound frequencies at or below 2 kHz (Illingworth & Rodkin 2007), which overlaps with the lower-frequency end of belugas' communication frequency band. While this does leave some bandwidth for communication, some interference is likely. These construction noises, though, do not mask echolocation clicks, and it is possible that this is the primary vocalization produced by beluga whales in this area because they are trying to avoid other loud frequency bands (ICRC 2009). While the driving of the ten piles will occur over a short time period within a very limited portion of the belugas'

range at a time of year when density is expected to be relatively low, some masking of vocal communication signals could occur. This is not expected to be of sufficient duration or intensity to prevent belugas or Steller sea lions from engaging in their essential biological functions (e.g. eating, resting, mating).

6.1.2. Disturbance

6.1.2.1. Belugas

Researchers have noted behavioral changes in captive beluga whales and other odontocetes when exposed to very loud impulsive sound (Finneran *et al.* 2000, 2002). During field observations in the Beaufort Sea, Miller *et al.* (2005) reported evidence of belugas avoiding large array seismic operations. Further, Romano *et al.* (2004) found that a captive beluga whale exposed to airgun sounds produced stress hormones with increasing sound pressure levels, and some hormone levels remained high as long as an hour after exposure (but these hormone levels were far less than those produced during beluga whale chase and capture events).

Although the above observations occurred during beluga exposure to sound pressure levels above those that would be produced by the pile-driving proposed for the current project, they demonstrate that belugas are susceptible to sound-induced stress and may be behaviorally and physiologically disturbed by loud noises, potentially leading to restricted use of available habitat when such sounds are produced. Due to its short duration, it is unlikely that the POA test pile project will result in hormonal changes due to stress in belugas; however, it will contribute to the overall level of anthropogenic sound in the area and could result in behavioral change. Kendall (2010) noted some changes in beluga group composition and more rapid passage past the POA during construction activities in 2008-2009, as compared with pre-construction observations. The POA is not believed to be an important area for essential beluga activities, so increased travel speed through the area, while indicating disturbance, likely does not indicate impairment of essential life functions.

6.1.2.2. Steller sea lions

CALTRANS (2001) reports that during a pile installation demonstration project at the San Francisco-Oakland Bay Bridge, while eight harbor seals did not show any avoidance response when pile driving commenced, three California sea lions (*Zalophus californianus*) rapidly swam and porpoised out of the area when pile driving began. The authors speculate that airborne noise from pile driving most likely played a part in startling the sea lions, which have a slightly greater sensitivity to airborne noise than do harbor seals (Richardson *et al.* 1995). However, a number of other factors may have been in play, which could not be explored in detail within the scope of the demonstration project.

Throughout their range, Steller sea lions are exposed to noises that exceed the NMFS disturbance criteria during use of tug boats and barges, and in many areas, Steller sea lions are attracted to fishing vessels as a food source. Given the short time frame of the test pile project and the low probability of sea lion occurrence in the action area, disturbance to Steller sea lion is improbable.

6.1.3. Threshold Shift (Hearing Loss)

Marine mammals exposed to high intensity sound repeatedly or for prolonged periods can experience hearing threshold shift, which is the loss of hearing sensitivity at certain frequency ranges. Threshold shift can be permanent (PTS), in which case the loss of hearing sensitivity is not recoverable (Yost 2007), or temporary (TTS), in which case the animal's hearing threshold recovers over time (Southall *et al*. 2007). Such impacts are of great concern to both pinnipeds (Kastak *et al*.2005) and cetaceans, which depend on acoustic cues for orientation, communication, finding prey, avoiding predators (Weilgart 2007). PTS has never been induced in marine mammals despite some hearing threshold studies exposing beluga whales to pulses up to 208 dB (Finneran *et al.* 2002a), 28 dB louder than NMFS's current Level A (injury potential) harassment threshold, and louder than the source levels of any sounds to be generated by pile driving associated with the POA Test Pile project.

Finneran *et al.* (2005) noted that 18 percent of exposures to an SEL of 195 dB re 1µPa^2 resulted in measurable TTS in beluga whales. During the proposed test pile project only belugas located within 1 m (2.5 ft) of the impact-driven pile could potentially experience TTS. It is unlikely that belugas will occur within this distance of a pile driving activity. Kastak *et al.* (2005) noted TTS onset in a California sea lion from in-air exposure to159 dB noise. The maximum distance that this noise level could occur from unattenuated impact pile driving is about 158 m. In contrast, Finneran *et al.* (2002b) found no TTS in two California sea lions exposed to 161 and 163 dB.

6.1.4. Injury and Mortality

There is a very low probability of Level A harassment, serious injury, or mortality to beluga whales or Steller sea lions associated with the POA Test Pile project. As stated above, the noise sources involved emit sound pressures that are too low to permanently injure listed marine mammals. Ship strikes of cetaceans can cause major wounds, which may lead to the death of the animal. However, there have been no reports of ship strikes of Steller sea lions in upper Cook Inlet or of belugas in Alaska (Gabriele *et al.* 2002), perhaps due in part to their greater maneuverability as compared with larger whales (Arctic Council 2009). The barges and tugs used for the test pile project will be operating at speeds well below the speed of 13 knots (15 mph) found to coincide with most whale-vessel collisions (Laist *et al*. 2001). We conclude that beluga whale or sea lion injury associated with the test pile project is extremely unlikely.

6.1.5. Noise Effects on Prey

Typical behavioral responses of fish to introduced sound, such as sound from seismic surveys, include: balance disturbance (i.e., staying in normal orientation); disoriented swimming behavior; increased swimming speed; disruption or tightening of schools; disruption of hearing; interruption of important biological behaviors (e.g., feeding, reproduction); shifts in the vertical distribution (either up or down); and occurrence of alarm and startle behaviors (BOEM 2015).

No acoustic impact studies have been conducted to date on the fish species most likely present during the summer months in Cook Inlet, but studies have been conducted on Atlantic cod (*Gadus morhua*) and sardine (*Clupea* sp.). Fish sensitivity to impulse sound such as that generated by pile driving varies depending on the species of fish. Cod,

herring and other species of fish with swim bladders are considered to be more sensitive to sound vibrations than fish species that lack swim bladders. An alarm response in these fish is elicited when the sound signal intensity rises rapidly compared to sound rising more slowly to the same level (Blaxter and Hoss 1981). Davis *et al.* (1998) cited various studies and found no effects to Atlantic cod eggs, larvae, and fry when received levels were 222 dB. What effects were found were to larval fish within about 5.0 m (16 ft), and from air guns with displacement volumes between 49,661 and 65,548 cm^3 (3,000 and 4,000 in^3). Similarly, effects to sardine were greatest on eggs and two-day larvae, within 0.5 m (1.6 ft) of the source, and again were confined to 5 m. Greenlaw *et al.* (1988) found no evidence of gross histological damage to eggs and larvae of northern anchovy (*Engraulis mordax*) exposed to seismic air guns, and concluded that noticeable effects would result only from multiple, close exposures.

Sound pressure levels greater than 150 dB are expected to cause temporary behavioral changes for fish, such as a startle or stress response. Although these sound pressure levels are not expected to cause direct injury to a fish, the functional effect of impaired sensory ability could potentially reduce survival, growth, and reproduction, increase predation, and alter foraging and reproductive behaviors. However, it is also likely that fish will avoid approaching sound sources within ranges that may cause harm (McCauley et al. 2003). The seismic sound in the action area will only be sufficient to cause behavioral changes to fish on a temporary and intermittent basis. This change will be of sufficiently short duration that NMFS concludes such behavioral effects on fish will not have measurable effects on beluga whale or western DPS Steller sea lion primary prey species.

Physiological effects to even very young fish from this proposed action will be limited to waters affected by particle motion rather than sound waves. The effects of particle motion are limited to within a few meters of the sound source for seismic airgun arrays of 3000-4000 in^3 displacement. Only a small fraction of the potentially available habitat in Cook Inlet will occur within several meters of sound sources at the POA project site. Therefore, only a small fraction of the primary prey species for Cook Inlet belugas or wDPS Steller sea lions run the risk of being physiologically impacted at levels sufficient to cause harm by “noise” (in this case, particle motion) from this proposed project.

Based on the discussion above, we conclude that noise associated with the POA test pile project poses no measurable risk to prey for Cook Inlet beluga whales or wDPS Steller sea lions.

6.2. Quantifying Potential for Noise-induced Take of Cook Inlet Beluga Whales

6.2.1. Ensonified Area (Zone of Influence)

The Permits Division (2015) quantified the total area to be ensonified by unmitigated impact and vibratory pile driving by applying the model for practical spreading loss of underwater sounds:

$$TL = 15 \log (R_2/R_1)$$

where R_1 is the distance of a known or measured sound level, and R_2 is the estimated distance required for sound to attenuate to a prescribed acoustic threshold, and 15 is a standard transmission loss coefficient, used for many marine projects, as a compromise

between spherical and cylindrical spreading loss when local information is unavailable and water depths are unknown or variable (NMFS 2012).

The POA Test Pile project differs from most operational pile-driving projects in that one of its primary purposes is to test the effectiveness of measures that will minimize sound-related impacts to belugas from the future APMP project. Project design is to drive piles both with the sound attenuation measures that are being tested and also partially with unattenuated pile-driving, for hydroacoustic comparison. In adopting the most conservative approach for effects to belugas, NMFS Permits Division (2015) calculated exposure analyses using sound generated from driving of unattenuated 48-inch piles.

The applicant and NMFS Permits Division used source levels (measured at 10 m) reported from the US Navy Explosive Handling Wharf in the Hood Canal, Puget Sound for unattenuated vibratory (164 dB $_{RMS}$) and impact (192 dB $_{RMS}$) driving of 48-inch diameter piles (Illingworth & Rodkin 2013) as representative for the POA test pile project. Using these source levels resulted in transmission loss values (required to meet NMFS thresholds) of 192-160 = 32 dB for impact and 164-125 = 39 dB for vibratory pile driving. Applying the practical spreading loss formula results in calculated **harassment threshold radii of 1.4 km for impact and 3.98 (rounded to 4) km for vibratory pile-driving for the piles that are driven in the absence of sound attenuation treatments**. **We expect sound attenuation equivalent to 10 dB for 8 of the piles driven as part of this program. The harassment threshold radii for piles driven while sound attenuation devices are used are 293 m for impact driving and 858 m for vibratory driving.**

For the purposes of this opinion, we have adopted the use of the practical spreading loss equation when calculating harassment radii because that is a risk-averse approach used by the Permits Division for its analysis

6.2.2. Exposure Estimate

Goetz *et al*. (2012) modeled aerial survey data collected by the NMFS June - July surveys between 1993 and 2008, and developed specific beluga summer densities for each 1-km^2 cell of Cook Inlet. The maximum density values within the action area of the POA project range from 0.031 to 0.063 beluga whale/km^2.

The number of beluga whales predicted to be exposed to project-related sound levels resulting in "Level B harassment" (considered equivalent to "take" for the purposes of this opinion) was then calculated according to the following formula:

$$E_{mmd} = D_{mm} \times A_e \times D_{pd}$$

Where: E_{mmd} is the number of marine mammal exposure days,
D_{mm} is the density of marine mammals,
A_e is the area of zone ensonified to $\geq$160 dB for impact or $\geq$125 dB for vibratory pile driving, and
D_{pd} is the number of days during which any pile driving will occur.

By this method, one "marine mammal exposure day" becomes equivalent to one marine

mammal exposed. NMFS (2015b) included a 25 percent contingency in the expected number of pile driving days to allow for unforeseen operational exigencies, bringing the anticipated number of pile driving days to 31. Note that within this 31-day period, only 27 total hours of pile driving are expected to occur. However, the applicant and NMFS Permits Division assessed exposure whereby, for the purposes of calculating take, any amount of pile driving during a day was considered to be one day of pile driving. For our jeopardy analysis, we adopt the take calculation procedure laid out by the applicant and NMFS Permits Division, acknowledging that this method likely overestimates take considerably.

Table 1 in the IHA proposal (NMFS 2015b) indicates that the ratio of impact to vibratory driving is anticipated to be 3:2; thus of the 31 days over which the project is expected to occur, impact and vibratory driving would occur over 18.5 days and 12.5 days respectively, or 1.85 and 1.25 days, respectively, for each of the 10 test piles.

In this biological opinion we note areas of uncertainty, or situations where data are not available. In analyzing the effects of the action, NMFS gives the benefit of the doubt to the listed species by minimizing the likelihood of false negative conclusions (i.e., concluding that adverse effects are not likely when such effects are, in fact, likely to occur). Accordingly, and in keeping with the way in which pile driving will actually occur, we are adding the estimated beluga exposure *per pile* from both impact and vibratory driving. The results of these calculations are shown in Table 2.

6.3. Quantifying Potential for Noise-induced Take of Steller Sea Lions

Steller sea lions are expected to be encountered in very low numbers within the action area, if they will occur there at all. Only three sightings of one individual Steller sea lion have occurred in Upper Cook Inlet since the mid-1980s. Those three sightings, from 2009, were likely of the same animal seen on three occasions. However, climate change-driven changes in animal distribution make us less confident about using historical data to project future occurrence, especially on the fringes of a species distribution. Based on these sightings and the vagaries introduced by climate change (see section 5.8), NMFS Permits Division (2015b) proposed an encounter rate of one individual for every five pile driving days across 31 driving days in the proposed authorization published in the Federal Register. Furthermore, Steller sea lions are social animals and often travel in groups, and a single sighting could include more than one individual. Therefore, the NMFS Permits Division conservatively estimates that six Steller sea lions could be observed at the POA during the proposed timeframe of the Test Pile Program. The Permits Division anticipated no Level A take of wDPS Steller sea lions due to the small radius (14 m) of the 190 dB Level A injury zone and the project's associated mitigation measures.

Table 2. NMFS AKR calculation of expected beluga whale exposures to impact and vibratory driving of the ten piles in the POA Test Pile project. Numbers in parentheses indicate sums of rounded impact and vibratory exposures.

Pile #	Impact pile driving area (km^2)	Impact driving max density (whales /km^2)	CIB Expo. per day impact driving	# days of impact driving	CIB Exposure from Impact driving	Vibratory pile driving area (km^2)	Vibrat. driving max density (whales /km^2)	CIB Expo. per day vibrat. driving	**# days of vibrat. driving**	CIB Expo. from Vibratory driving	**TOTAL CIB Exposure per pile**[1]

Pile 3	2.24	0.031	0.06944	1.85	0.13	15.54	0.056	0.87024	1.25	1.09	**1.22**
Pile 4	2.24	0.031	0.06944	1.85	0.13	15.54	0.056	0.87024	1.25	1.09	**1.22**
Pile 1	2.71	0.042	0.11382	1.85	0.21	19.54	0.063	1.23102	1.25	1.54	**1.75**
Pile 2	2.76	0.038	0.10488	1.85	0.19	20.08	0.062	1.24496	1.25	1.56	**1.75**
Pile 5	2.79	0.062	0.17298	1.85	0.32	20.9	0.062	1.2958	1.25	1.62	**1.94**
Pile 6	2.79	0.062	0.17298	1.85	0.32	20.9	0.062	1.2958	1.25	1.62	**1.94**
Pile 7	2.8	0.062	0.1736	1.85	0.32	20.95	0.062	1.2989	1.25	1.62	**1.94**
Pile 8	3.03	0.042	0.12726	1.85	0.24	22.14	0.063	1.39482	1.25	1.74	**1.98**
Pile 9	3.03	0.042	0.12726	1.85	0.24	22.14	0.063	1.39482	1.25	1.74	**1.98**
Pile 10	3.03	0.042	0.12726	1.85	0.24	22.14	0.063	1.39482	1.25	1.74	**1.98**
Total impact driving exposures					2.34	Total vibratory driving exposures				15.36	
Total number of exposures= 17.74											

[1]Total CIB exposure per pile is the sum of CIB exposure from both impact and vibratory driving. Hereafter, we round the expected value of 17.74 up to 18.

6.4. Indirect Effects

Indirect effects defined under the ESA are effects from the proposed action that occur later in time, but are still reasonably certain to occur. In the future, it is likely that POA will propose construction activities for the full-scale Anchorage Port Modernization Project (APMP). Mitigation measures proposed to be used in the APMP will be based on results obtained from the test pile project. The APMP will require additional Federal authorization and permitting, which would trigger further ESA section 7 review. Therefore, future development of the APMP is not considered an indirect effect of the current action.

7.0. CUMULATIVE EFFECTS

Cumulative effects pursuant to the ESAare 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." Many cumulative effects will result (or continue) from activities and sources discussed above under Environmental Baseline (Section 4), summarized below.

7.1. Fisheries

Fishing, a major industry in Alaska, is expected to continue in Cook Inlet. As a result, there will be continued prey competition, risk of ship strikes, potential harassment, potential for entanglement in fishing gear, and potential displacement from foraging habitat for Cook Inlet beluga whales and wDPS Steller sea lions. ADF&G will continue to manage fish stocks and monitor and regulate fishing in Cook Inlet to maintain sustainable stocks and minimize any adverse effects to marine mammals.

7.2. Oil and Gas Development

It is likely that oil and gas development will continue in Cook Inlet with associated risks to belugas and wDPS Steller sea lions from seismic activity, vessel and air traffic, well drilling operations, wastewater discharge, habitat loss, and potential for oil spills and natural gas well blowouts. Any such proposed development would undergo ESA section 7 consultation and therefore the associated effects are not cumulative effects pursuant to the ESA.

7.3. Coastal Development

Coastal development may result in the loss of habitat, increased vessel traffic, increased pollutants, and increased noise associated both with construction and with the activities associated with the projects after construction. Any future projects with a Federal nexus will require section 7 consultation. However as the human population in the area increases, coastal development with unspecified impacts to Cook Inlet could occur, and vessel traffic in the area could increase.

There are two Alaska tidal energy projects under consideration. One would be located on the west side of Fire Island (near Anchorage) and the other adjacent to the East Foreland in the vicinity of Nikiski on the Kenai Peninsula (ORPC 2011). The tidal energy projects would require the installation of an array of turbine generator units and transmission cables on the seafloor to harness the tidal energy. The tidal energy will be converted to electrical energy at stations on land. These projects are still in preliminary testing and environmental monitoring phases (ORPC 2010, 2011). There may be a Federal nexus associated with such a project, but that is uncertain at this time.

7.4. Pollution

As the population in urban areas continue to grow, an increase in pollutants entering Cook Inlet is likely to result. Hazardous materials may be released into Cook Inlet from vessels, aircraft, and municipal runoff. There is a possibility an oil spill could occur from vessels traveling within the action area, or that oil could migrate into the action area from a nearby spill. There are many nonpoint 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 Cook Inlet and beluga habitat. However, the EPA and the ADEC will continue to regulate the amount of pollutants that enter Cook Inlet from point and nonpoint sources through NPDES/APDES permits. As a result, permittees will be required to renew their permits, verify they meet permit standards, and potentially upgrade facilities.

7.5. Tourism

There currently are no commercial whale-watching companies in upper Cook Inlet. The popularity of whale watching and the close proximity of beluga whales to Anchorage make it a theoretical possibility 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 and associated human safety risks).

Vessel-based whale-watching, should it occur, may cause stress to Cook Inlet beluga whales through increased noise and intrusion into beluga habitat not ordinarily disturbed by boats. Avoidance reactions have often been observed in beluga whales 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 2008a). The small size and low profile of beluga whales, and the poor visibility within the Cook Inlet waters, may result in closer-than-intended approaches to beluga whales, closer than usually permitted for marine mammals. General marine mammal viewing guidelines would be adopted, and possibly enhanced, for any commercial beluga whale watching tours. Steller

sea lions are extremely unlikely to be a focal point for any such tours because they are so uncommon in Cook Inlet, and so common elsewhere in less hazardous and more picturesque waters.

7.6. Subsistence Hunting

Alaska Natives, while not currently hunting Cook Inlet belugas, may continue to hunt harbor seals in Cook Inlet for subsistence purposes, as allowed by the MMPA. These are typically boat-based hunts that could temporarily increase noise in the environment and increase the potential for accidental ship strikes of Cook Inlet belugas. Any future hunts of Cook Inlet belugas will likely require a Federal authorization and are not considered under the ESA definition of cumulative impacts. To our knowledge, hunting of Steller sea lions does not occur in Cook Inlet.

7.7 Vessel Traffic

Unregulated harassment is likely occurring as a result of small vessels operations, aircraft overflights, and other actions by humans, but there are no data available to quantify the extent of this harassment. Of these stressors, vessel traffic may be of most concern, with the potential to harass beluga whales, displace them from important feeding habitat near the mouths of certain salmon streams, and injure them by strikes with boat hulls or propellers. However, it appears that at least some of the time, beluga whales continue to occupy feeding areas despite small boat traffic (including feeding habitat in the Susitna Delta where they have continued to engage in feeding activity while they were actively hunted by subsistence hunters). Elsewhere in their range, the whales flee from small boats engaged in activities unrelated to the belugas. It is unknown whether the whales sometimes fail to flee from boat traffic because they have habituated to it, or because the food resources at that time and place are so vital to their survival that they have no choice but to tolerate the boat traffic.

Ship strikes have not been implicated as the cause of death for any stranded Cook Inlet beluga whales, although many stranding investigations are inconclusive, and at least one stranded beluga showed trauma consistent with what one would expect from a collision with a boat hull.

8.0. SUMMARY OF EFFECTS

Belugas and Steller sea lions may experience disturbance in areas ensonified by the POA test pile project that generate sound with frequencies within their hearing range and at levels above disturbance threshold values. Over the entire 31-day operating period of the test pile project, an estimated maximum of 227 km^2 may be ensonified by impact and vibratory pile driving. This estimate is based on values derived from the generic "practical spreading loss" model, which is the standard that NMFS applies nationally, in lieu of locally-derived data.

8.1 Cook Inlet Beluga Whales

We calculated 18 Cook Inlet beluga whales may be exposed to sound sources that constitute Level B harassment as a result of sound-producing activities associated with this project. However, the NMFS Permits Division incorporates into the proposed IHA for this project a reasonable estimate of 26 Level B harassment takes for Cook Inlet Belugas.. Therefore, we base our jeopardy analysis on the Permits Division's estimate of

26 belugas that are expected to be taken by harassment.

Mitigation measures described in Section 2.1.2, as modified by the Incidental Take Statement associated with this Biological Opinion, will be implemented throughout the duration of the test pile project to reduce incidence and severity of exposure of Cook Inlet beluga whales to project-related noise. Mitigation measures include: (1) monitoring of harassment zones; (2) assuring the harassment zones are clear of marine mammals prior to start-up; (3) soft start procedures; and (4) shutdown protocols and procedures.

8.2 Steller Sea Lion

Quantifying effects of the test pile project to Steller sea lions is difficult due to the low numbers and sporadic presence of the species in the project area. NMFS (2015b) states that:

> *Steller sea lions are expected to be encountered in low numbers, if at all, within the project area. However, based on the three sightings of what was likely a single individual in the project area in 2009, the POA requests the take of up to 6 individuals over the duration of test pile driving activities. The proposed Test Pile Program will drive piles for approximately 31 days, and therefore, the proposed encounter rate of Steller sea lions is 1 individual about every 5 pile driving days.*

As indicated in Section 6.3, we conclude that, based on historical sighting rates since the mid-1980s, take of six wDPS Steller sea lions during an estimated 27 hours of pile driving conducted over 31 days is an overestimate. However, because climate change renders us less able to project with confidence the future distribution of this species on the fringes of its range, we are basing our jeopardy analysis on the Permits Division's estimated take of six wDPS Steller sea lions (see section 6.1).

Throughout their range, Steller sea lions are likely frequently exposed to sounds exceeding MMPA Level B harassment thresholds from continuous noise sources, such as marine vessel traffic. They appear to be most sensitive to visual disturbance at their haulout locations. Given the lack of sea lion haulouts anywhere near the action area and the very infrequent occurrence of sea lions in the action area, Level B sounds from the proposed action are not expected to have a long term impact on individual wDPS Steller sea lions, or any population level effect.

9.0 INTEGRATION AND SYNTHESIS

In this section, we synthesize the direct and indirect effects of the POA Test Pile project on Cook Inlet beluga whales and wDPS Steller sea lions and integrate those effects with the environmental baseline and cumulative effects. We then consider the implication of those effects on the continued existence of Cook Inlet beluga whales and wDPS Steller sea lions. In particular, we examine the scientific data available to determine whether there may be responses to the effects of the project that are likely to have consequences for the individual's growth, survival, annual reproductive success, or lifetime reproductive success. Any reduction in these parameters for an individual whale or sea lion could incrementally affect the viability of the entire listed entity. On the other hand, when animals are not expected to experience reductions in fitness, we would not expect the action to have adverse consequences on the population.

During our analysis of effects to individual Cook Inlet beluga whales or wDPS Steller sea lions associated with the Port of Anchorage Test Pile Program, we made some assumptions about these species' habitats, hearing abilities, and behaviors. The ESA does not require scientific certainty. In this Biological Opinion, AKR has utilized the best available scientific data to evaluate the consequences from the Test Pile Program.

In considering uncertainty, we are cautious to not speculate or make unsupported assumptions. We remain unable to relate take by harassment to changes in survival, productivity, fitness or population trends for listed species affected by this action. However, a reasonable impact assessment can still be conducted by considering: (1) the status of the population; (2) population trends; (3) the species' documented reactions to harassment; (4) the consequence of these reactions to individuals; (5) the impact of those individual reactions to the species; and (6) the degree of uncertainty in the relationship between harassment and changes in the species' probability of survival and recovery.

Uncertainty is also considered as we manage risk. We know the continued survival of the Cook Inlet beluga is precarious, with a 26 percent probability of extinction within 100 years. The consequence of uncertainty in our ability to promote the survival and recovery of these whales is great. To avoid Type II errors, (i.e., concluding that the animal was not affected when in fact it was) in situations with many uncertainties, we take a precautionary approach. That is, we assume an effect that *may* occur actually *will* occur. The acceptability of risk is a function of the status of the species/habitat in question; and for the Cook Inlet beluga whale, the threshold for acceptable levels of risk is quite low.

9.1. Cook Inlet Beluga Whales

As we have detailed in previous biological opinions (e.g., NMFS 2015c) and conservation documents (NMFS 2008a, b, 2015a) the baseline condition for Cook Inlet beluga whales is characterized by: (1) very low abundance; (2) lack of recovery; and (3) a high probability of extinction within the next 100 years (Hobbs and Shelden 2008). The additional annual mortality of even a single animal above that predicted in the population viability model would accelerate this predicted extinction timeframe. At the same time, this population faces continuing, but unquantified, natural and anthropogenic threats and has displayed a lack of recovery despite the discontinuation of the threat that is widely regarded as the reason for the population's precipitous decline (unsustainable harvest).

Our review of the cumulative effects to Cook Inlet beluga whales found an unquantified intensity of threats from activities without a Federal nexus, for which no consultation would occur under the ESA. Unregulated harassment is likely occurring as a result of vessel traffic, aircraft overflights, and other actions by humans. However, there are no data available to quantify the effects of this harassment. As we discussed, vessel traffic may displace Cook Inlet beluga whales from important feeding habitat near the mouths of certain salmon streams, and may injure them by strikes with boat hulls or propellers. Ship strikes have not been implicated as the cause of death for any stranded Cook Inlet beluga whales, although many stranding investigations are inconclusive, and at least one stranded beluga showed trauma consistent with what one would expect from a collision with a boat hull.

While beluga whales are likely being subjected to take under the environmental baseline and through cumulative effects, such takes are thought to be mostly due to harassment and disturbance by noise. We are currently unable to quantify the effects of this harassment upon the extinction risk probabilities for this DPS. However, a reasonable impact assessment can still be conducted by considering the status of the population, population trends, the species' reactions to harassment, and the consequence of that reaction to individuals, and by extension, to the DPS.

Authorization of the proposed POA test pile project activities may result in the harassment of Cook Inlet beluga whales from pile driving sound levels above the harassment threshold. The proposed IHA for the POA test pile project would authorize Level B harassment take of up to 26 Cook Inlet beluga whales (about 7.6 percent of the population). The most likely manifestations of this harassment take would be temporary changes in behavior in which animals would return to their normal behavior shortly after cessation of exposure to noise levels exceeding 125 dB for vibratory or 160 dB for impact pile driving. Over the calculated 31 days of project activity, pile driving is estimated to occur for 21 hours (impact) and 6 hours (vibratory).

We anticipate individual Cook Inlet beluga whales could be exposed to MMPA Level B harassment take as a result of the POA test pile project. However, there is no known data to indicate that short-term exposure to sound sources constituting Level B harassment would have a negative consequence to an individual beluga whale's fitness (i.e., growth, survival, or reproductive success), or would result in population-level consequences to survival or recovery of the Cook Inlet beluga whales; such data would be extremely difficult to gather for a wild population.

As previously indicated, factors that may affect recovery include prey availability, access to foraging areas, contaminants, direct mortality events (e.g., ship strikes, researcher induced take), stranding events, and killer whale predation. It is unlikely that the proposed test pile project will affect these factors in a way that would measurably decrease the species' probability of, or time to, recovery. The POA test pile project is not expected to measurably affect any individual beluga whale's fitness due to several factors, including:

- the short duration of active pile driving (roughly 2 hours per pile)[4];
- the small number of piles to be driven (10);
- the use of sound attenuation methods which are expected to reduce the radii of Level B disturbance zones,
- the visual and acoustic monitoring program in place which will help avoid harassment of beluga whales, and
- clearing, soft-start and power/shut-down procedures that will reduce the number of instances of harassment to beluga whales.

Accordingly, we do not expect the proposed action to affect survival or recovery such that the continued existence of the Cook Inlet beluga whale is likely to be jeopardized.

[4] This estimated duration of pile driving stands in stark contrast to the estimated 3.1 days of pile driving required per pile as estimated by the Permits Division (Table 2).

On integrating the effects from the proposed POA test pile project on Cook Inlet beluga whales with the environmental baseline and cumulative effects, we expect that individual or small groups of whales may be harassed by impulsive and non-impulsive noise from project activities, but we conclude take associated with this project will be limited to temporary behavioral changes. Take resulting from this project is not likely to have measurable population-level effects to the Cook Inlet beluga whale (26/340 = 7.6 percent of the population affected). Beluga whales are highly unlikely to be killed or injured by this project, and harassment is expected to be localized and temporary. Furthermore, the project will provide information that may have a net benefit to the species, in developing methods for minimizing and mitigating sound levels of pile driving that may be effectively implemented in future projects, including the much more extensive Anchorage Port Modernization Project.

9.2 Steller Sea Lions

The exposure and response analyses above lead us to conclude there is a likelihood that up to six endangered wDPS Steller sea lion may be exposed to project noise exceeding NMFS Level B acoustic thresholds. Therefore, we conclude that population level effects are not likely to occur as a result of this project, where we expect 6/45,659[5] or of the population may be taken.

10.0 CONCLUSION

After reviewing the project description, mitigation measures, status of these species, effects from the action, environmental baseline, and cumulative effects, it is NMFS's biological opinion that the proposed authorization by NMFS Permits Division and the Corps of Engineers for the POA Test Pile Project is not likely to jeopardize the continued existence of Cook Inlet beluga whales or wDPS Steller sea lions.

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 (or is authorized by law) and if: 1) the amount or extent of incidental take is exceeded in any operational year; 2) new information reveals effects from 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.

11.0 INCIDENTAL TAKE STATEMENT

Section 9 of the ESA prohibits the take of endangered species without a 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) of the ESA, taking that is incidental to an otherwise lawful agency action is not considered to be prohibited taking under the ESA, provided that such taking is in compliance with the

[5] Where 45,659 is the minimum population estimate for wDPS Steller Sea Lions.

terms and conditions of an Incidental Take Statement (ITS).

Section 7(b)(4)(C) of the ESA provides that if an endangered or threatened marine mammal is involved, the take must first be authorized by Section 101(a)(5) of the MMPA. Accordingly, the terms of this incidental take statement and the exemption from Section 9 of the ESA become effective only upon the issuance of MMPA authorization to take the marine mammals identified here.

This ITS will be in effect only upon the issuance of MMPA authorization to take the marine mammals identified herein, and will remain in effect throughout the period specified in the IHA, provided the operator possesses a current and valid IHA and ITS at all times during project operations. Should the operator fail to possess such an authorization, this ITS is void.

11.1 Special Note Concerning Shutdown Zone

The applicant and NMFS (2015b) propose shutting down pile-driving operations under the following circumstances: (a) if a marine mammal approaches a 100 m radius of vibratory or impact pile driving; (b) if a group of 5 or more belugas approaches the Level B harassment zone for impact or vibratory pile driving; or (c) if a beluga calf is sighted approaching the Level B harassment zone. These conditions reflect criteria from the 2009 NMFS Biological Opinion the Marine Terminal Redevelopment Project at the Port of Anchorage. However, recently analyzed data indicate that the range of Cook Inlet belugas has contracted substantially, and is now centered much closer to the Port of Anchorage (NMFS 2015a; Rugh *et al.* 2010 – see also Figure 2). This new information, coupled with the species' continued decline during a period of time when recovery was expected, increases the importance of minimizing disturbance to the remaining Cook Inlet belugas. In recent Biological Opinions for Cook Inlet-based seismic exploration actions from 2015 and 2016, NMFS AKR has consistently required powering down or shutting down of acoustically-impacting activities when one or more Cook inlet beluga whales are observed within or approaching Level B harassment zones (sometimes referred to as disturbance zones) (NMFS 2015c, NMFS 2016).

This requirement minimizes the incidence and intensity of acoustic disturbance to these endangered whales.
Term and Condition 2.2 and 2.5 address this potential obstacle to successful project completion.

11.2 Amount or Extent of Take

Because the IHA application bases its estimate of take of Cook Inlet beluga whales on survey densities and a reasonable interpretation of that data, NMFS AKR adopts the Permits Division's estimate of take and therefore **we authorize the non-lethal incidental take of up to 26 Cook Inlet beluga whales** as a result of exposure to project-related impulsive sounds $\geq$160 dB and <180 dB, and to non-impulsive sounds $\geq$ 125 dB and <180 dB. NMFS also concludes that an expected take of up to 6 wDPS Steller Sea lions is reasonable, not based on historical observations, but primarily due to the uncertainties

of projecting the occurrence of a species on the fringe of its range during a time when it may be adapting to climate change. **We therefore authorize the non-lethal incidental take of up to six wDPS Steller sea lions** as a result of exposure to project-related impulsive sounds ≥160 dB and <190 dB, and to non-impulsive sounds ≥ 125 dB and <190 dB. NMFS does not expect marine mammals to be injured or killed by this action. Although this project may result in behavioral disturbance to a small number of Cook Inlet beluga whales and/or wDPS Steller sea lions, planned monitoring and mitigation measures are designed to minimize the number of instances of exposure and the intensity of exposure of listed marine mammals to sound pulses that may cause disturbance.

11.3 Effect of the Take

The taking of Cook Inlet beluga whales and wDPS Steller sea lions shall be by incidental harassment only. The taking by serious injury or death, or the taking by harassment of a greater number of animals than authorized by this Incidental Take Statement, is prohibited and may result in the modification, suspension, or revocation of this ITS.

In Section 10 of the biological opinion associated with this ITS, we conclude that this level of take by harassment, in addition to other effects of the proposed action, is not likely to jeopardize the continued existence of Cook Inlet beluga whales or wDPS Steller sea lions.

11.4. Reasonable and Prudent Measures (RPMs)

"Reasonable and prudent measures" are nondiscretionary measures to minimize the amount or extent of incidental take (50 CFR 402.02).

The RPMs included below, along with their implementing terms and conditions, are designed to minimize the impact of incidental take that might otherwise result from the proposed action. NMFS concludes that the following RPMs are necessary and appropriate to minimize or to monitor the incidental take of Cook Inlet beluga whales and wDPS Steller sea lions resulting from the proposed action.

1. The Corps and the Permits Division must require the Port of Anchorage to implement a comprehensive monitoring program to ensure that Cook Inlet beluga whales and Steller sea lions are not taken in numbers or in a manner not anticipated by the biological opinion.

2. The Corps and the Permits Division must require the Port of Anchorage to conduct operations in a manner that will minimize impacts to Cook Inlet beluga whales and wDPS Steller sea lions that occur within or in the vicinity of the project action area.

3. The Corps and the Permits Division must require the Port of Anchorage to evaluate the effectiveness of mitigation measures incorporated into the IHA and as set forth in this Biological Opinion for the incidental taking of ESA-listed marine mammals pursuant to section 101(a)(5)(D) of the MMPA.

4. The Corps and the Permits Division must require the Port of Anchorage to provide all marine mammal monitoring data and metadata in a digital form that is readily accessible and compatible with industry standard software.

11.5 Terms and Conditions

For any incidental takes that result from the actions of NMFS Permits Division, the Corps, or their applicant or permittees to be exempt from the prohibitions of section 9 of the ESA, the action that causes the take must comply with the following terms and conditions (T&Cs). These non-discretionary terms and conditions implement the reasonable and prudent measures described above. These measures are non-discretionary and must be a binding condition of the Permits Division's and Corps' authorizations for the exemption in section 7(o)(2) to apply. If these Federal agencies (1) fail to require the authorization holder to adhere to the terms and conditions of the Incidental Take Statement through enforceable terms that are added to the authorization, and/or (2) fail to retain oversight to ensure compliance with these terms and conditions, the protective coverage of section 7(o)(2) may lapse.

To implement RPM #1:

1. The Port of Anchorage must provide monthly observer reports, a final observer report, and completed marine mammal observation record forms (attached) during the project. Items 1.1 through 1.4, below, provide details about what must be included in the reports.
    - 1.1. The reporting period for each monthly observer report will be the entire calendar month, and reports will be submitted by close of business on the 5th business day of the month following the end of the reporting period (e.g., The monthly report covering March 1 through 31, 2016, will be submitted to NMFS Alaska Region by close of business (i.e., 5:00 pm, AKST) on April 7th, 2016).
        - 1.1.1. Completed and well-documented marine mammal observation records, in standard electronic format, must be provided to NMFS Alaska Region in monthly reports.
        - 1.1.2. Observer report data must include the following for each listed marine mammal observation (or "sighting event" if repeated sightings are made of the same animal[s]):
            - 1.1.2.1. Species, date, and time for each sighting event
            - 1.1.2.2. Number of animals per sighting event and number of adults/juveniles/calves/pups per sighting event
            - 1.1.2.3. Primary, and, if observed, secondary behaviors of the marine mammals in each sighting event
            - 1.1.2.4. Geographic coordinates for the observed animals, with the position recorded by using the most precise coordinates practicable (coordinates must be recorded in decimal degrees, or similar standard, and defined coordinate system)
            - 1.1.2.5. Time of most recent pile-driving or other project activity prior to marine mammal observation
            - 1.1.2.6. Environmental conditions as they existed during each sighting event, including, but not limited to:
                - 1.1.2.6.1. Beaufort Sea State

1.1.2.6.2. Weather conditions
1.1.2.6.3. Visibility (km/mi)
1.1.2.6.4. Lighting conditions
1.1.2.6.5. Percentage of ice cover

1.1.3. Observer report data must also include the following for each take of a marine mammal that occurs in the manner and extent as described in this Opinion:
1.1.3.1. All information listed under Item 1.1.2, above
1.1.3.2. Cause of the take (e.g., Cook Inlet beluga whale observed within Level B harassment zone during vibratory pile driving)
1.1.3.3. Time the animal(s) entered the zone, and, if known, the time it exited the zone
1.1.3.4. Mitigation measures implemented prior to and after the animal entered the zone

1.2. A final technical report must be submitted to NMFS Alaska Region within 90 days after the final pile has been driven. The report must summarize all pile-driving and other project activities and results of marine mammal monitoring conducted during project activities. The final technical report must include all elements from Item 1.1, above, as well as:
1.2.1. Summaries that include monitoring effort (e.g., total hours, total distances, and marine mammal distribution through the study period, accounting for sea state and other factors that affect visibility and detectability of marine mammals)
1.2.2. Analyses on the effects from various factors that influences detectability of marine mammals (e.g., sea state, number of observers, fog, glare, etc.)
1.2.3. Species composition, occurrence, and distribution of marine mammal sightings, including date, water depth, numbers, age/size/sex categories (if determinable), group sizes, and ice cover
1.2.4. Species composition, occurrence, and distribution of marine mammal takes, including date, water depth, numbers, age/size/sex categories (if determinable), group sizes, and ice cover
1.2.5. Analyses of effects of project activities on listed marine mammals
1.2.6. Number of marine mammals observed and taken (by species) during periods with and without project activities (and other variables that could affect detectability), such as:
1.2.6.1. Initial sighting distances versus project activity at time of sighting
1.2.6.2. Observed behaviors and movement types versus project activity at time of sighting
1.2.6.3. Numbers of sightings/individuals seen versus project activity at time of sighting
1.2.6.4. Distribution around the action area versus project activity at time of sighting

1.3. If unauthorized take occurs, (i.e., Level B take of any ESA-listed species other than Cook Inlet beluga whale or wDPS Steller sea lion or Level A take of any ESA-listed species), it must be reported to NMFS Alaska Region within one business day to the contact listed in Item 1.4, below. Observation records for ESA-listed marine mammals taken in a manner or to the extent described in this Opinion must include:

1.3.1. All information listed under Item 1.1, above
1.3.2. Number of listed animals taken
1.3.3. Date and time of each take
1.3.4. Cause of the take (e.g., Steller sea lion observed within Level A zone of impact pile driving or Cook Inlet beluga whale observed in the Level B zone during vibratory pile driving)
1.3.5. Time the animal(s) entered the zone, and, if known, the time it exited the zone
1.3.6. Mitigation measures implemented prior to and after the animal entered the zone

1.4. NMFS Contacts:
Monthly and final reports and reports of unauthorized take must be submitted to:
NMFS Alaska Region, Protected Resources Division
Greg Balogh
Greg.balogh@noaa.gov
907-271-3023 or 907-271-5006

To implement RPM #2:

2. The NMFS Permits Division and the Corps must ensure that measures outlined in this Biological Opinion and Incidental Take Statement are implemented as a means to minimize take of threatened and endangered species.

2.1. If one or more beluga whales are observed entering, or appear likely to enterthe >160 dB Level B harassment zone for impact pile driving or the >125 dB level B harassment zone for vibratory pile driving operations, pile driving must cease immediately. The radii for Level B harassment zones for piles driven **without** the use of sound attenuation devices are 1.4 km from the source for impact pile driving and 4.0 km from the source for vibratory pile driving. The radii for Level B harassment zones for piles driven **with** the use of sound attenuation devices are 293 m from the source for impact pile driving and 858m from the source for vibratory pile driving. This term and condition explicitly replaces the mitigation measure for shutdown proposed by the POA that is reflected in the IHA proposal, where the applicant proposes to shut down for groups of beluga whales or individual beluga whale calves.

2.1.1. Pile driving may commence when Protected Species Observers confirm that listed marine mammals are absent from the harassment zone or 15 minutes have elapsed since listed marine mammals were last observed in the harassment zone.

2.2. In lieu of the harassment zone radii provided in term and condition 2.1, during the sound source verification (SSV) study, the radii of the harassment zones may alternately be defined by acoustic data collected in real time or earlier during the Port of Anchorage test pile SSV. If one or more beluga whales are observed entering the SSV-defined harassment zone, pile driving must cease immediately.

2.3. The harassment zone for vibratory pile driving must be monitored beginning at least 30 minutes prior to the soft-start and during all vibratory pile driving, and must continue after cessation of vibratory pile driving if impact driving is to commence within 30 minutes of vibratory driving of the same pile.

2.4. The harassment zone for impact pile driving must be monitored beginning at least 30 minutes prior to the soft-start and during all impact pile driving. If impact driving commences within 30 minutes of vibratory driving and observers confirm that a 1.4-km radius Level B harassment zone has remained clear of Cook Inlet beluga whales and wDPS Steller sea lions for 30 minutes prior to the start of impact driving, a soft start will not be required for impact driving.

To implement RPM #3:

3. The NMFS Permits Division and the Corps must ensure that the mitigation measures incorporated as part of the authorization and as set forth in this Biological Opinion are implemented and evaluated as to their effectiveness.

3.1. The measured radii of harassment zones must be reported for each pile, noting the sound attenuation treatment, if any, applied to that pile. This information must be incorporated in the final technical report submitted to NMFS as per term and condition 1.2.

3.2. The final technical report outlined in term and condition 1.2 must contain a narrative and, if practicable, a quantitative evaluation of all mitigation measures in terms of reducing the incidence and severity of take of listed marine mammals.

To implement RPM #4:

4. Digital records, including data required by term and condition 1-1.4, photos, maps, images and associated metadata, of observations made by PSOs associated with this project must be made available to NMFS. All data and associated metadata will be submitted to NMFS AKR in a form that can be directly imported into an Excel or similar spreadsheet software.

12.0 CONSERVATION RECOMMENDATIONS

ESA Section 7(a)(1) directs Federal agencies to use 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 activities to minimize or avoid adverse effects of a proposed action on listed species or critical habitat, to help carry out recovery plans, or to develop information (50 CFR 402.02). In anticipation of future development of the Anchorage Port Modernization Project (APMP), conservation recommendations are as follows:

1. When calculating marine mammal exposure estimates, NMFS Permits Division and the applicant should consider using *number of hours* of pile driving activity per day rather than *number of days during which any pile driving occurs*. Adopting this method will provide a more realistic estimation of exposure, particularly in view of the much more extensive pile-driving activity that is likely to occur during the APMP.

2. We applaud the foresight of the POA and contractors on plans to verify the sound sources and *actual* distances to the NMFS acoustic thresholds for marine mammal injury (Level A) and disturbance (Level B) of impulsive and vibratory pile driving. Your results will replace theoretical formulas (as used in this consultation) for calculating transmission loss with actual measurements to the sound thresholds at the same location where future activity of the same type is proposed to occur. We encourage the publication of the SSV results in an open source peer reviewed journal to maximize availability of the results to the public.

3. POA will maintain a minimum buffer of 10 miles (16.1 km) between the perimeter of their 160dB harassment zone and the perimeter of the harassment or disturbance zone for other entities who have obtained MMPA or ESA take authorization[6].

4. Personnel and contractors at POA should continue to report sightings of any stranded beluga whale immediately to the NOAA Fisheries Stranding Hotline, 877-925-7773.

13.0. REINITIATION OF CONSULTATION

As provided in 50 CFR §402.16, reinitiation of formal consultation is required where discretionary Federal agency involvement or control over the action has been retained (or is authorized by law) and if: (1) the amount or extent of incidental take is exceeded in any operational year; (2) new information reveals effects from 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. In instances where the amount of incidental take is exceeded, section 7 consultation must be reinitiated immediately.

14.0. DATA QUALITY ACT DOCUMENTATION AND PRE-DISSEMINATION REVIEW

Section 515 of the Treasury and General Government Appropriations Act of 2001 (Public Law 106-554) (Data Quality Act (DQA)) specifies three components contributing to the quality of a document. They are utility, integrity, and objectivity. This section of the opinion addresses these DQA components, documents compliance with the DQA, and certifies that this opinion has undergone pre-dissemination review.

[6] The size of the disturbance zone for other authorized entities will depend upon factors, including sound source level, use of sound attenuation devices, application of appropriate sound source verification measurements, whether the sound is impulsive or non-impulsive, and other factors. The disturbance zone exists only during those times when ensonification occurs at levels sufficient to cause harassment ($\geq$160 dB).

14.1. Utility

This document records the results of an interagency consultation. The information presented in this document is useful to NMFS, the Corps, and the general public. These consultations help to fulfill multiple legal obligations of the named agencies. The information is also useful and of interest to the general public as it describes the manner in which public trust resources are being managed and conserved. The information presented in these documents and used in the underlying consultations represents the best available scientific and commercial information and has been improved through interaction with the consulting agency.

This consultation will be posted on the NMFS Alaska Region website http://alaskafisheries.noaa.gov/protectedresources/). The format and name adhere to conventional standards for style.

14.2. Integrity

This consultation was completed on a computer system managed by NMFS in accordance with relevant information technology security policies and standards set out in Appendix III, 'Security of Automated Information Resources,' Office of Management and Budget Circular A-130; the Computer Security Act; and the Government Information Security Reform Act.

14.3. Objectivity

Standards: This consultation and supporting documents are clear, concise, complete, and unbiased; and were developed using commonly accepted scientific research methods. They adhere to published standards including the ESA Consultation Handbook, ESA Regulations, 50 CFR 402.01 et seq.

Best Available Information: This consultation and supporting documents use the best available information, as referenced in the literature cited section. The analyses in this opinion contain more background on information sources and quality.

Referencing: All supporting materials, information, data and analyses are properly referenced, consistent with standard scientific referencing style.

Review Process: This consultation was drafted by NMFS staff with training in ESA implementation, and reviewed in accordance with Alaska Region ESA quality control and assurance processes.

15.0. LITERATURE CITED

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