DEPARTMENT OF COMMERCE

National Oceanic and Atmospheric Administration

[RTID 0648–XD366]

Takes of Marine Mammals Incidental to Specified Activities; Taking Marine Mammals Incidental to the Port of Alaska's North Extension Stabilization Step 1 (NES1) Project in Anchorage, Alaska

AGENCY: National Marine Fisheries Service (NMFS), National Oceanic and Atmospheric Administration (NOAA), Commerce.

ACTION: Notice; proposed incidental harassment authorization; request for comments on proposed authorization and possible renewal.

SUMMARY: NMFS has received a request from the Port of Alaska (POA) for authorization to take marine mammals incidental to the NES1 project at the existing port facility in Anchorage, Alaska. Pursuant to the Marine Mammal Protection Act (MMPA), NMFS is requesting comments on its proposal to issue an incidental harassment authorization (IHA) to incidentally take marine mammals during the specified activities. NMFS is also requesting comments on a possible one-time, 1-year renewal that could be issued under certain circumstances and if all requirements are met, as described in the Request for Public Comments section at the end of this notice. NMFS will consider public comments prior to making any final decision on the issuance of the requested MMPA authorization and agency responses will be summarized in the final notice of our decision.

DATES: Comments and information must be received no later than December 5, 2023.

ADDRESSES: Comments should be addressed to Jolie Harrison, Chief, Permits and Conservation Division, Office of Protected Resources, National Marine Fisheries Service and should be submitted via email to *ITP.tyson.moore@noaa.gov.* Electronic copies of the application and supporting documents, as well as a list of the references cited in this document, may be obtained online at: *https://www.fisheries.noaa.gov/national/marine-mammal-protection/incidental-take-authorizations-construction-activities.* In case of problems accessing these documents, please call the contact listed above.

Instructions: NMFS is not responsible for comments sent by any other method, to any other address or individual, or received after the end of the comment period. Comments, including all attachments, must not exceed a 25-megabyte file size. All comments received are a part of the public record and will generally be posted online at *https://www.fisheries.noaa.gov/national/marine-mammal-protection/incidental-take-authorizations-construction-activities* without change. All personal identifying information (*e.g.,* name, address) voluntarily submitted by the commenter may be publicly accessible. Do not submit confidential business information or otherwise sensitive or protected information.

FOR FURTHER INFORMATION CONTACT: Reny Tyson Moore, Office of Protected Resources, NMFS, (301) 427–8401.

SUPPLEMENTARY INFORMATION:

Background

The MMPA prohibits the ''take'' of marine mammals, with certain exceptions. Sections 101(a)(5)(A) and (D) of the MMPA (16 U.S.C. 1361 *et seq.*) direct the Secretary of Commerce (as delegated to NMFS) to allow, upon request, the incidental, but not intentional, taking of small numbers of marine mammals by U.S. citizens who engage in a specified activity (other than commercial fishing) within a specified geographical region if certain findings are made and either regulations are proposed or, if the taking is limited to harassment, a notice of a proposed IHA is provided to the public for review.

Authorization for incidental takings shall be granted if NMFS finds that the taking will have a negligible impact on the species or stock(s) and will not have an unmitigable adverse impact on the availability of the species or stock(s) for taking for subsistence uses (where relevant). Further, NMFS must prescribe the permissible methods of taking and other ''means of effecting the least practicable adverse impact'' on the affected species or stocks and their habitat, paying particular attention to rookeries, mating grounds, and areas of similar significance, and on the availability of the species or stocks for taking for certain subsistence uses (referred to in shorthand as ''mitigation''); and requirements pertaining to the mitigation, monitoring and reporting of the takings are set forth. The definitions of all applicable MMPA statutory terms cited above are included in the relevant sections below.

National Environmental Policy Act

To comply with the National Environmental Policy Act of 1969 (NEPA; 42 U.S.C. 4321 *et seq.*) and NOAA Administrative Order (NAO) 216–6A, NMFS must review our proposed action (*i.e.,* the issuance of an IHA) with respect to potential impacts on the human environment. Accordingly, NMFS has prepared an Environmental Assessment (EA) to consider the environmental impacts associated with the issuance of the proposed IHA. NMFS' EA is available at *https://www.fisheries.noaa.gov/national/marine-mammal-protection/incidental-take-authorizations-construction-activities.* We will review all comments submitted in response to this notice prior to concluding our NEPA process or making a final decision on the IHA request.

Summary of Request

On July 19, 2022, NMFS received a request from the POA for an IHA to take marine mammals incidental to construction activities related to the NES1 project in Anchorage, Alaska. Following NMFS' review of the application, the POA submitted revised versions on December 27, 2022, July 28, 2023, and August 31, 2023. The application was deemed adequate and complete on September 7, 2023. The POA submitted a final version addressing additional minor corrections on September 21, 2023. The POA's request is for take of seven species of marine mammals by Level B harassment and, for a subset of these species (*i.e.,* harbor seal (*Phoca vitulina*) and harbor porpoise (*Phocoena phocoena*)), Level A harassment. Neither the POA nor NMFS expect serious injury or mortality to result from this activity and, therefore, an IHA is appropriate.

NMFS previously issued IHAs to the POA for similar work (85 FR 19294, April 6, 2020; 86 FR 50057, September 7, 2021). The POA complied with all the requirements (*e.g.,* mitigation, monitoring, and reporting) of the previous IHAs, and information regarding their monitoring results may be found in the Effects of the Specified Activity on Marine Mammals and their Habitat and Estimated Take section of this notice and online at *https://www.fisheries.noaa.gov/national/marine-mammal-protection/incidental-take-authorizations-construction-activities.*

This proposed IHA would cover 1 year of the ongoing Port of Alaska Modernization Program (PAMP) for which the POA obtained prior IHAs and intends to request additional take authorization for subsequent facets of the program. The PAMP involves construction activities related to the modernization of the POAs marine terminals.

Description of Proposed Activity

Overview

The POA, located on Knik Arm in upper Cook Inlet, provides critical infrastructure for the citizens of Anchorage and a majority of the citizens of Alaska. The North Extension at the POA is a failed bulkhead structure that was constructed between 2005 and 2011. Parts of the North Extension bulkhead structure and the surrounding upland area are unstable and collapsing, and some of the sheet piles are visibly twisted and buckled. The structure presents safety hazards and logistical impediments to ongoing Port operations, and much of the upland area is currently unusable. The NES project would result in removal of the failed sheet pile structure and reconfiguration and realignment of the shoreline within the North Extension, including the conversion of approximately 0.05 square kilometers (km^2; 13 acres) of developed land back to intertidal and subtidal habitat within Knik Arm. The NES project would be completed in two distinct steps, NES1 and NES2, separated by multiple years and separate permitting efforts. This notice is applicable to a proposed IHA for the incidental take of marine mammals during in-water construction associated with NES1.

The NES1 project would involve the removal of portions of the failed sheet pile structure to stabilize the North Extension. The POA anticipates this project would begin on April 1, 2024 and extend through November 2024. They estimate that work would occur over approximately 250 hours on 110 nonconsecutive days. The NES1 project would remove approximately half of the North Extension structure extending approximately 274 meters (m) north from the southern end of the North Extension. This project would also stabilize the remaining portion of the North Extension by creating an end-state embankment. In-water construction associated with this project includes vibratory installation and removal of 81 24-inch (61-centimeter (cm)) or 36-inch (91-cm) temporary steel pipe stability template piles and vibratory removal, pile splitting and pile cutting (and possible impact removal) of approximately 4,216 sheet piles from the structure tailwalls, cell faces (bulkhead), and closure walls. Sound produced by these construction activities may result in the take of marine mammals, by harassment only.

Dates and Duration

The POA anticipates that NES1 in-water construction activities would begin on April 1, 2024 and extend through November 2024. In-water pile installation and removal associated with the NES1 project is anticipated to take place over approximately 246.5 hours on 110 nonconsecutive days between these dates (see table 1 for estimated production rates and durations). While the exact sequence of demolition and construction is uncertain, an estimated schedule of sheet pile removal and temporary stability template pile installation and removal is shown in Table 2.

TABLE 1—PILE INSTALLATION AND REMOVAL METHODS AND ESTIMATED DURATIONS

Pile type	Pile size	Structural feature	Total estimated number of piles	Estimated number of piles in the water	Average vibratory and/or splitter duration	Maximum impact strikes per day	Total duration of removal and installation in water (hours)	Average production rate, piles per day (range)	Estimated number of days
PS 27.5 and PS 31 Sheets.	19.69 inches (50 cm).	Tailwalls	3,536	2,267	2 hours/day	150	157	50 (10 to 100)	46
PS 27.5 and PS 31 Sheets.	19.69 inches (50 cm).	Cell Faces (Bulkhead).	568	568	2 hours/day	150	41	30 (10 to 60)	19
PZC26 Sheets	27.88 inches (70 cm).	Closure Walls	110	110	2 hours/day	150	8	50 (10 to 100)	3
Steel Pipe	24- or 36-inch (61- or 91-cm) install.	Temporary Stability Templates.	81	81	15 min/pile	0	20.25	4 (2 to 10)	21
Steel Pipe	24- or 36-inch (61- or 91-cm) removal.	Temporary Stability Templates.	81	81	15 min/pile	0	20.25	4 (2 to 10)	21
Total							246.5		110

Note: cm = centimeter(s).

TABLE 2—ESTIMATED TIMING AND DURATION BY MONTH OF PILE INSTALLATION AND REMOVAL ACTIVITIES

Activity	April	May	June	July	August	September	October	November	Total
36-inch (91-cm) or 24-inch (61-cm) stability template pile installation:									
Piles	27	14	14	10	10	3	3	0	81
Hours	6.75	3.50	3.50	2.5	2.5	0.75	0.75	0	20.25
36-inch (91-cm) or 24-inch (61.cm) stability template pile removal:									
Piles	0	27	13	13	13	10	4	1	81
Hours	0	6.75	3.25	3.25	3.25	2.5	1	0.25	20.25
Sheet pile vibratory hammer removal:									
Piles									
Hours	10	45	60	60	13	10	4	2	206
Total hours	16.75	55.25	66.75	65.75	18.75	15.25	5.75	2.25	246.50

The POA has presented this schedule using the best available information derived from what is known of the North Extension Site and the POA's experience with similar construction and demolition projects. The POA plans to conduct as much work as possible prior to August through October, when there is higher Cook Inlet beluga whale (CIBW; *Delphinapterus leucas*) abundance. However, as described below, due to the instability of the North Extension site, it is important that the POA attempt to complete the NES1 in a single construction season, which may necessitate work in August through October. Potential consequences of pausing the construction season (*i.e.,* stopping work from August through October) include de-rating the structural capacity of existing POA docks, a shutdown of dock operations due to deteriorated conditions, or an actual collapse of one or more dock structures. The potential for collapse increases with schedule delays, due to both worsening deterioration and the higher probability of a significant seismic event.

A typical construction season at the POA extends from approximately mid-April to mid-October (6 months) and may include November. Exact dates of ice-out in the spring and formation of new ice in the fall vary from year to year and cannot be predicted with accuracy. In-water pile installation and removal cannot occur during the winter months when ice is present because of the hazards associated with moving ice floes that change directions four times a day, preventing the use of tugs, barges, workboats, and other vessels. Ice movement also prevents accurate placement of piles.

Due to the design of the existing sheet pile wall, demolition must occur in a sequential and uninterrupted manner to prevent structural failure of the wall as demolition progresses. This safety requirement limits the POA's ability to re-sequence in-water sheet pile extraction and temporary pile installation, as the already compromised bulkhead structure may become further destabilized. The POA therefore plans to complete all work between April and November 2024, and requests an IHA for the NES1 project for 1 year that is effective as of April 1, 2024. All pile-driving would occur during daylight hours.

Specific Geographic Region

The Municipality of Anchorage is located in the lower reaches of Knik Arm of upper Cook Inlet (see Figure 2–1 in the POA's application). The POA sits on the industrial waterfront of Anchorage, just south of Cairn Point and north of Ship Creek (lat. 61°15′ N, long. 149°52′ W; Seward Meridian). Knik Arm and Turnagain Arm are the two branches of upper Cook Inlet, and Anchorage is located where the two arms join.

Cook Inlet is a large tidal estuary that exchanges waters at its mouth with the Gulf of Alaska. The inlet is roughly 20,000 km² in area, with approximately 1,350 linear kilometer (km) of coastline (Rugh *et al.,* 2000) and an average depth of approximately 100 m. Cook Inlet is generally divided into upper and lower regions by the East and West Forelands. Freshwater input to Cook Inlet comes from snowmelt and rivers, many of which are glacially fed and carry high sediment loads. Currents throughout Cook Inlet are strong and tidally periodic, with average velocities ranging from 3 to 6 knots (Sharma and Burrell, 1970). Extensive tidal mudflats occur throughout Cook Inlet, especially in the upper reaches, and are exposed at low tides.

Cook Inlet is a seismically active region susceptible to earthquakes and has some of the highest tides in North America (NOAA, 2015) that drive surface circulation. Cook Inlet contains substantial quantities of mineral resources, including coal, oil, and natural gas. During winter, sea, beach, and river ice are dominant physical forces within Cook Inlet. In upper Cook Inlet, sea ice generally forms in October to November, and continues to develop through February or March (Moore *et al.,* 2000).

Northern Cook Inlet bifurcates into Knik Arm to the north and Turnagain Arm to the east. Knik Arm is generally considered to begin at Point Woronzof, 7.4 km southwest of the POA. From Point Woronzof, Knik Arm extends about 48 km in a north-northeasterly direction to the mouths of the Matanuska and Knik rivers. At Cairn Point, just northeast of the POA, Knik Arm narrows to about 2.4 km before widening to as much as 8 km at the tidal flats northwest of Eagle Bay at the mouth of Eagle River.

Knik Arm comprises narrow channels flanked by large tidal flats composed of sand, mud, or gravel, depending upon location. Approximately 60 percent of Knik Arm is exposed at Mean Lower Low Water (MLLW). The intertidal (tidally influenced) areas of Knik Arm are mudflats, both vegetated and unvegetated, which consist primarily of fine, silt-sized glacial flour. Freshwater sources often are glacially born waters, which carry high suspended sediment loads, as well as a variety of metals such as zinc, barium, mercury, and cadmium. Surface waters in Cook Inlet typically carry high silt and sediment loads, particularly during summer, making Knik Arm an extremely silty, turbid waterbody with low visibility through the water column. The Matanuska and Knik Rivers contribute the majority of fresh water and suspended sediment into Knik Arm during summer. Smaller rivers and creeks also enter along the sides of Knik Arm (U.S. Department of Transportation and Port of Anchorage, 2008).

Tides in Cook Inlet are semidiurnal, with two unequal high and low tides per tidal day (tidal day = 24 hours, 50 minutes). Due to Knik Arm's predominantly shallow depths and narrow widths, tides near Anchorage are greater than those in the main body of Cook Inlet. The tides at the POA have a mean range of about 8 m, and the maximum water level has been measured at more than 12.5 m at the Anchorage station (NMFS, 2015). Maximum current speeds in Knik Arm, observed during spring ebb tide, exceed 7 knots. These tides result in strong currents in alternating directions through Knik Arm and a well-mixed water column. The navigation harbor at the POA is a dredged basin in the natural tidal flat. Sediment loads in upper Cook Inlet can be high; spring thaws occur, and accompanying river discharges introduce considerable amounts of sediment into the system (Ebersole and Raad, 2004). Natural sedimentation processes act to continuously infill the dredged basin each spring and summer.

The POA's boundaries currently occupy an area of approximately 0.52 km². Other commercial and industrial activities related to secured maritime operations are located near the POA on Alaska Railroad Corporation property immediately south of the POA, on approximately 0.45 km² at a similar elevation. The POA is located north of Ship Creek, an area that experiences concentrated marine mammal activity during seasonal runs of several salmon species. Ship Creek serves as an important recreational fishing resource and is stocked twice each summer. Ship Creek flows into Knik Arm through the Municipality of Anchorage industrial area. Joint Base Elmendorf-Richardson (JBER) is located east of the POA, approximately 30.5 m higher in elevation. The U.S. Army Defense Fuel Support Point-Anchorage site is located east of the POA, south of JBER, and north of Alaska Railroad Corporation property. The perpendicular distance to the west bank directly across Knik Arm from the POA is approximately 4.2 km. The distance from the POA (east side) to nearby Port MacKenzie (west side) is approximately 4.9 km.

Detailed Description of the Specified Activity

The POA, located on Knik Arm in upper Cook Inlet (Figure 1), provides critical infrastructure for the citizens of Anchorage and a majority of the citizens of Alaska. Marine-side infrastructure and facilities at the POA were constructed largely in the 1960s and are in need of replacement because they are substantially past their design life and in poor and deteriorating structural condition. Those facilities include three general cargo terminals, two petroleum terminals, a dry barge landing, and an upland sheet-pile-supported storage and work area. To address deficiencies, the POA is modernizing its marine terminals through the PAMP to enable safe, reliable, and cost-effective Port operations. The PAMP will support infrastructure resilience in the event of a catastrophic natural disaster over a 75-year design life.

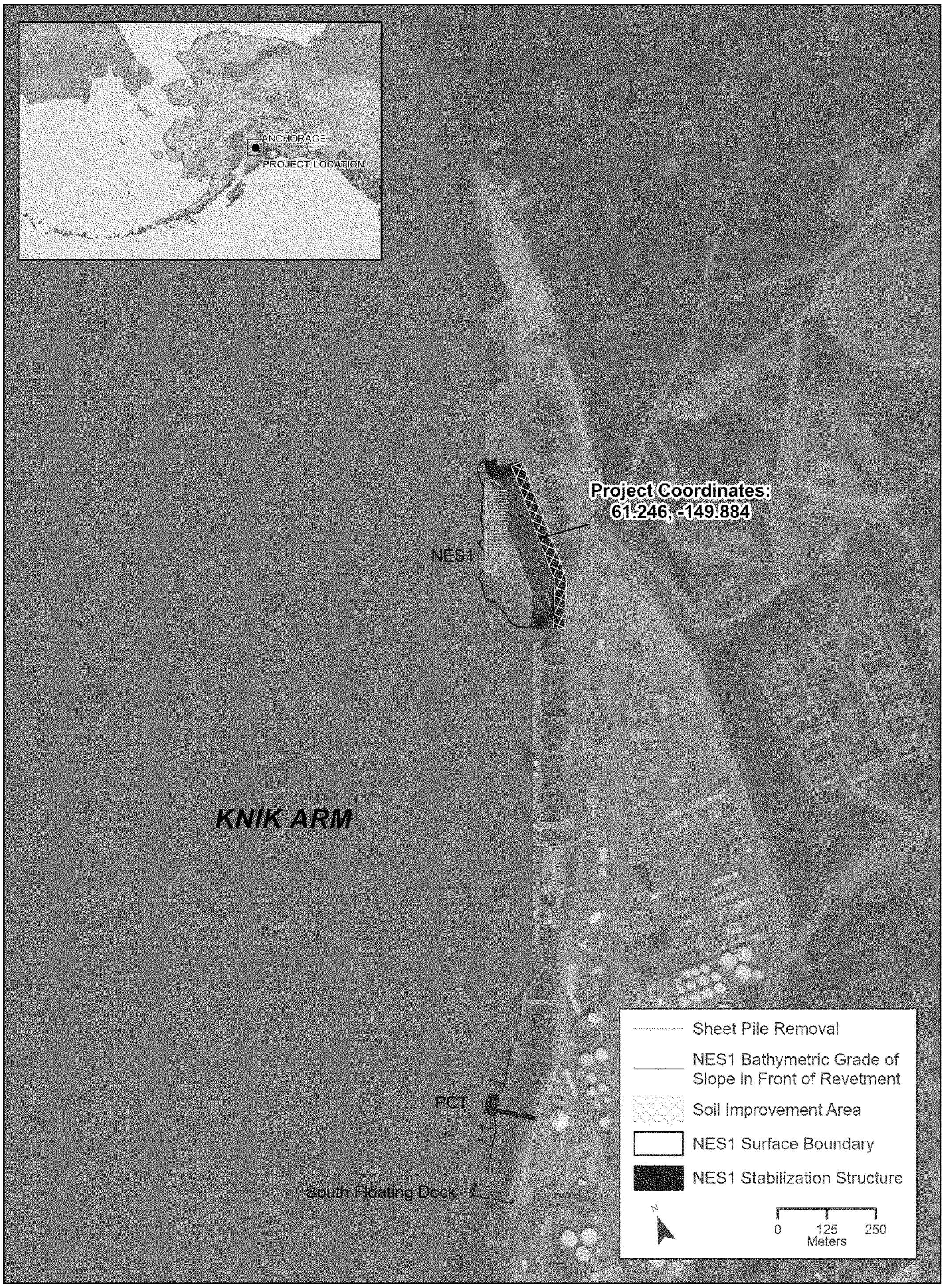

Figure 1 -- Overview of North Extension Stabilization 1

The PAMP is critical to maintaining food and fuel security for the state. At the completion of the PAMP, the POA will have modern, safe, resilient, and efficient facilities through which more than 90 percent of Alaskans will continue to obtain food, supplies, tools, vehicles, and fuel. The PAMP is divided into five separate phases; these phases are designed to include projects that have independent utility yet streamline agency permitting. The projects associated with the PAMP include:

- *Phase 1:* Petroleum and Cement Terminal (PCT Phase 1 and 2) and South Floating Dock (SFD) replacement;
- *Phase 2A:* NES1;
- *Phase 2B:* General Cargo Terminals Replacement (construction planned to begin in 2025);
- *Phase 3:* Petroleum, Oil and Lubricants Terminal 2 Replacement;
- *Phase 4:* NES2; and
- *Phase 5:* Demolition of Terminal 3.

Phase 1 of the PAMP was completed in 2022. IHAs were issued by NMFS for both the PCT (Phase 1 and Phase 2; 85 FR 19294, April 6, 2020) and SFD projects associated with this Phase (86 FR 50057, September 7, 2021). The NES Project would be completed in two distinct steps, NES1 and NES2, separated by multiple years and separate permitting efforts. The project discussed herein, NES1, is Phase 2A of the PAMP. Ground improvements work in preparation for NES1 began in 2023, and on-shore and in-water work for NES1 is planned to commence in April 2024.

The North Extension (the area north of the existing general cargo docks) was constructed in 2005–2011 under the Port Intermodal Expansion Project (PIEP), the predecessor effort to the PAMP. The POA considers the North Extension a failed structure. Parts of the North Extension bulkhead structure and the surrounding upland area are unstable and collapsing, and some of the sheet piles are visibly twisted and buckled. The structure presents safety hazards and logistical impediments to ongoing Port operations, and much of the upland area is currently unusable. The currently proposed NES Project overall would result in removal of the failed sheet pile structure and reconfiguration and realignment of the shoreline within the North Extension. NES1 would include the conversion of approximately 0.05 km^2 (13 acres) of developed land back to intertidal and subtidal habitat within Knik Arm. While the majority of the Project will be demolition work, the term ''construction'' as used herein refers to both construction and demolition work.

The purpose of the NES Project is to stabilize the previously failed North Extension bulkhead structure and create a new shoreline that is structurally and seismically stable and balances the preservation of uplands created in the past while addressing the formation of unwanted sedimentation within the U.S. Army Corps of Engineers (USACE) Anchorage Harbor. The NES Project will also improve safety for maneuvering vessels at the northern berths. Previous establishment of the North Extension changed the hydrodynamics of the area and resulted in more rapid accumulation of sediments at the existing cargo dock faces, as well as a smaller turning area for vessels. The Municipality of Anchorage and the POA have identified the NES Project as a priority for the PAMP, due to the impact of the existing structure's geometry upon the USACE Anchorage Harbor Project, mariners' concerns regarding impacts to safe ship-berthing operations, and engineering concerns regarding structural and geotechnical stability of the system. The existing structure poses significant risk for continued deterioration and could result in significant release of impounded fill material into the Port's vessel operating and mooring areas, and into the USACE Anchorage Harbor Project. Accordingly, a significant portion of the NES work has been designated for inclusion in NES1 as Phase 2A PAMP efforts, specifically those portions of the existing structure that are closest to the north end of the existing cargo terminals. Creation of a safe and stable uplands area will support POA operations while also addressing concerns of adverse impacts upon the Federal Navigation Channel and Dredging Program.

Existing North Extension Structure

The existing North Extension bulkhead structure is an OPEN CELL SHEET PILE (OCSP) design. Demolition of the existing OCSP structure will include removal and disposal of the southerly OCSP bulkhead walls and associated backlands. The OCSP bulkhead is a retaining structure filled with soil that is composed of 29 interconnected open cells, each approximately 8 m wide, with 30 tailwalls that are up to 61 m long (see Figure 1–3 in the POA's application). Each cell is about 20 sheets wide across the face, which is along the water. Each tailwall consists of approximately 118 sheet piles that extend landward into the filled area, orthogonal to the sheet piles along the face (table 1). The sheet piles interlock through a series of thumb-finger joints or interlocks (where two sheet piles are connected along their length; see Figure 1–5 in the POA's application) along the cell faces and tailwalls. Wye joints occur where three sheet piles are connected at the interface between two neighboring sheet pile cell faces and the adjoining tailwall (see Figure 1–6 in the POA's application). Two z-pile closure walls close the gaps between structures, one on each end of the bulkhead (see Figure 1–4 in the POA's application). The total number of sheet piles in the existing structure that would be removed is approximately 4,216, although the exact number of sheet piles in the existing structure is not known with certainty.

Demolition of the failed sheet pile structure would be accomplished through excavation and dredging of impounded soils (fill material), and cutting and removal of the existing sheet piles, most likely through use of a splitter and vibratory hammer. Demolition of the OCSP cell components would not commence until ground improvements necessary to protect the horizontal to vertical ratio (H:V) of 2H:1V embankment slope have been completed. Ground improvements were scheduled for 2023 and are underway. The sequencing of in-water events, including how construction would proceed while maintaining stability among the structure's cells, is unknown. It is anticipated that the actual methods, including types of equipment and numbers of hours and days of each activity, would be determined based on the engineering specifications for the NES1 project as determined by the Construction Contractor and the Design Build Team designer of record (DOR). The NES1 DOR and Construction Contractor have been selected by the POA, but their Construction Work Plan has not yet been completed and some actual construction techniques are likely to be refined adaptively as construction advances due to the stability risk of the existing impounded materials. The following project description is based on the best available information at this time considering the POA's knowledge of the condition of the North Extension and their experience with similar marine construction and demolition projects, which NMFS has determined sufficient for the purposes of the IHA application.

NES1 Project Activities

The NES1 Project would result in a reconfiguration and realignment of the shoreline through removal of portions of the failed sheet pile structure to stabilize the North Extension. Before NES1 commences, the upland area would be prepared with ground improvements to stabilize the existing fill. Ground improvements will take place in the dry, landward of the existing failed sheet pile structure and underneath the area where filter rock and armor rock would later be placed to stabilize the new shoreline. Ground improvement work began in 2023.

Construction of NES1 will include completion of the following tasks:

- Dredging and offshore disposal of approximately 1.35 million cubic yards (CY) of material down to −12 m MLLW;
- Excavation of 115,000 CY of material;
- Demolition and removal of the failed existing sheet pile structure; and
- Shoreline stabilization including placement of granular fill, filter rock, and armor rock along the new face of the shoreline.

NES1 would remove approximately half of the North Extension structure extending approximately 274 m north from the southern end of the North Extension. NES1 would also stabilize the remaining portion of the North Extension by creating an end-state embankment with a top elevation of +12 m MLLW, sloping to a toe elevation of approximately −12 m MLLW. The lower portion of the embankment slope from −12 m MLLW to approximately 0 m MLLW would be constructed with a 6H:1V slope and would be unarmored. A grade-break would occur above these elevations as the slope will transition to a 2H:1V slope armored rock revetment.

At the cell faces, the depth of the face wall sections varies, with most extending from a tip elevation of approximately −60 MLLW to a cutoff elevation of approximately +9 m MLLW (27 m long). The mudline at the face sheets varies but is thought to be at approximately −11 m MLLW. This translates into a requirement to demolish sheet piles approximately 25 m high from the −14-m MLLW elevation to the top of the containment.

Demolition of the failed sheet pile structure would be accomplished through excavation and dredging of impounded soils (fill material), and cutting and removal of the existing sheet piles. Approximately 1,465,000 CY of material would be removed. The material removed from excavation (115,000 CY) would be stockpiled in the North Extension area for future use, while the dredged material (1,350,000 CY) would be disposed of offshore into the Anchorage Harbor Open Water Disposal Site, which is the authorized USACE offshore disposal area used by the POA under USACE permit POA–2003–00503–M20.

The NES1 Project in-water work would begin with landside excavation and in-water dredging along the south shoreline and south half of the failed sheet pile structure. Any methodology considered for cutting and removing the steel sheet piles would account for worker safety, constructability, and minimization of potential acoustic impacts that the operation may have on marine mammals. The first attempt would be to extract the sheet piles with direct vertical pulling or with a vibratory hammer; however, there may be complications with the sheet pile interlocks, which could become seized, and other means of pile removal may be required (*i.e.* shearing or torching). Demolition activities would begin with the south half of the existing structure, followed by the north half of NES1 (see Figure 1–8 in the POA's application). The majority of the demolition work would occur from the water side to eliminate safety hazards from unexpected movements of fill material or the sheet piles themselves. The demolition plan also includes stabilization of the face sheets through installation of temporary piles and dredging back into the cell to relieve pressure on the sheet piles and to eliminate any release of material into Cook Inlet beyond natural tidal forces.

Safety is a top priority regarding planning and executing the work. There are several risks at the project site to consider when planning demolition activities, such as strong currents and large tidal swings. Existing sheet piles and their interlocks are in poor condition. Many of the sheets may be damaged and bound up, making removal difficult. There are stability concerns with the failed OCSP structure, where the POA would have to closely manage allowable fill differentials between adjacent cells and loading on the face sheets. In-water NES1 activities and quantities are summarized in Table 3 (NES1 activities to be completed on land are summarized in table 1–2 in the POA's application).

TABLE 3—SUMMARY OF IN-WATER NES1 PROJECT STAGES, ACTIVITIES, AND APPROXIMATE QUANTITIES

Type of activity	Size and type	Total anticipated amount or number
Dredging of fill material	Granular fill	1,350,000 CY.
At-sea transit and disposal of dredged fill	Granular fill	1,350,000 CY.
Cutting piles with sheet splitter (vertical)	19.69-inch (50 cm) sheet piles, cut into vertical	Unknown.[1]
Cutting piles with shears or torch (horizontal)[2]	19.69-inch (50 cm) sheet piles	Unknown.[1]
Vibratory or direct pull removal of sheet piles[3]	19.69-inch (50 cm) sheet piles, removed in vertical panels.	4,216 sheet piles.
Installation and removal of temporary steel pipe piles	81 24- or 36-inch (61- or 91-cm) piles	81 installations, 81 removals.
Slope construction	Bedding, filter rock, armor stone	60,500 CY.

[1] The total number of sheet piles to be cut would be a subset of the estimated 4,216 sheet piles needed to be removed.
[2] Deploying divers or underwater shear equipment would be the last resort for removing sheet piles.
[3] Most of the waterside face and tailwall sheets would be cut in the dry to improve operational safety.

Dredging and Disposal

Dredging would be performed with a derrick barge using a clamshell bucket, and would likely take place for 24 hours per day for the duration of the project. One barge would perform the dredging associated with the sheet pile removal, working concurrently and in support of the crane barge removing the sheets. Another barge would perform dredging in the remaining proposed project area. This barge would start with removing the existing armor rock on the south slope and work its way north behind the OSCP bulkhead. Dredged material would be placed on a dump barge and taken by tug boat for disposal at the Anchorage Harbor Open Water Disposal Site.

Dredging for NES1 will take place in an area that has been part of a working port for more than 50 years, where dredging activities are common. Take of marine mammals by dredging is not anticipated or proposed to be authorized due to the low intensity and stationary nature of the sounds produced by dredging and its perennial presence over many years in the same general location near the project site. Further, the sounds produced by dredging are not meaningfully different and are unlikely to exceed sounds produced by ongoing normal industrial activities at the port. Lastly, mitigation measures described in the Proposed Mitigation section would ensure that direct physical interaction with marine mammals during dredging activities would be avoided. Therefore, dredging will not be considered further in this notice.

Excavation

Landside excavation would occur with loaders and excavators to remove the top portion of fill material and open up work for initial sheet pile cutting and removal. This excavation would begin to relieve pressure along the sheet wall face and expose the tops of the sheet piles to mitigate the risk of damaging sheets while dredging with a clamshell bucket. The sheet piles could be more easily extracted if undamaged. The removal elevation would remain above +5 m MLLW in order for the land equipment to reach the excavation depth with the groundwater and tidal elevations and ensure that the removed material would be in good condition. The material removed would be stockpiled at the POA for future use. Excavation would occur out of water. Therefore, take of marine mammals related to excavation activities is not anticipated or proposed to be authorized, and it will not be considered further in this notice.

Pile Installation and Removal

The sheet pile removal process would begin with the installation of stability templates (steel pipe piles) along the face of the sheet pile structure, following excavation and initial dredging work. Once landside excavation has removed the top portion of fill along the face of the wall, the POA would follow behind and begin dredging the material within the cells while maintaining the allowable fill differential between adjacent cells to maintain structural integrity. Before dredging deeper than the allowable elevation determined by the engineer, a crane barge would install temporary stability templates along the face of the sheet pile structure. The addition of about 27 temporary stability templates would support about one-third of the bulkhead sheet pile wall during removal of the impounded material. These templates would reinforce the sheets as material is dredged and hold them upright to prohibit any sheet deformation and improve the efficiency and effectiveness of removal. The templates would also minimize the need to perform horizontal cuts at multiple elevations, including underwater. With strong currents and low visibility, performing horizontal cuts underwater poses significant challenges. After that area has been demolished, the temporary stability template piles would be removed and re-installed along the next third of the bulkhead. It is anticipated that three sets of 27 temporary piles would be required for a total of 81 installations and 81 removals (table 1). The POA anticipates that the temporary stability template piles would be 24-inch (61-cm) steel pipe piles. However, it is possible that 36-inch (91-cm) steel pipe piles would be used instead. Temporary piles would be installed and removed with a vibratory hammer.

The POA would begin on the southern end of the sheet pile structure and work their way north along the sheet wall face, installing templates and dredging fill material while managing fill elevations from cell to cell (see Figure 1–10 in the POA's application for an example section for the proposed demolition work). Fill material would slide down into the dredge area and would continue to be removed until a cell has been dredged down to −12 m MLLW adjacent to the face sheets and all pressure of the fill material on the face has been relieved. At this point in time, the crane barge would begin removing the sheet piles, starting with the face sheets.

Some sheet piles from the tailwalls would be removed in the dry, potentially during excavation, depending on construction sequencing and tide heights. To minimize potential impacts on marine mammals from in-water sheet pile removal with a vibratory hammer, removal in the dry would be maximized as feasible; however, until the Construction Contractor and DOR are under contract, the exact number of sheet piles that may be removed in the dry is unknown. It is estimated that approximately 20–30 percent of sheet piles would be removed in the dry.

Additionally, it is possible that some sheet piles may be removed by direct pulling. Removal of sheet piles by direct pulling where and when possible would also be maximized as feasible. Once fill material and impounded soils have been excavated or dredged from both sides of the sheet piles, it may be adequate to dislodge the sheet piles out of interlock by lifting or direct pulling.

Although some sheet piles and sheet pile sections would be removed by direct pulling and/or in the dry, it is anticipated that some sheet piles and sheet pile sections would need to be removed with a vibratory hammer in water. Sheet piles may not be extracted easily if soil adheres to the sheet piles along the embedded length. It is also possible that competent portions of the interlocks would resist movement, or that interlocks that are bent or damaged by shearing would be difficult to separate and require shaking with a vibratory hammer.

During vibratory removal, a vibratory hammer would be suspended from a crane and connected to a powerpack. The extractor jaw would be hydraulically locked onto the web of the sheet pile. The pile would be vibrated as upward vertical force is applied to extract the pile. Ideally, the piles would slide within the interlock, separating from the adjacent piles. This may not always be the case, as the pile may bind, and multiple piles may be dislodged from the original installed position. Another potential outcome of a pile that binds up is that the pile web (the thin, flat part between the interlocks) may be compromised from corrosion or other damage, resulting in the web steel tearing and partially ripping the pile, necessitating the application of vertical force to a neighboring pile.

Vertical cuts to split the sheet piles into panels may be made with a sheet splitter if the interlocks do not release (see Figure 1–10 in the POA's application). The specific tools that would be used for pile splitting are not known, but it is anticipated that a splitter would be used. A pile splitter is a stiffened steel H-beam with some of the webbing removed. The edges of the H-beam webbing are hardened and form a large wedge between the flanges. The wedge is set on top of the sheet pile webbing where a cut is required. The splitter is then driven with a hammer down the webbing of the sheet pile until the tip of the H-beam passes the tip of the sheets, cutting the sheet pile all the way through and separating it into two parts. Multiple cuts split the sheet pile wall into tall vertical panels that can be removed in smaller pieces. Cuts in the sheet piles may be spaced 4 to 6 sheets apart and multiple sheets or pieces would be removed together. Splitters can be used in the air, water, or in soils and can be driven with impact or vibratory hammers. The splitter would be used in conjunction with a vibratory hammer and the POA assumed splitting would produce the same or similar sound levels to a vibratory hammer used without the splitter attachment. Therefore, the POA combined use of a vibratory hammer to remove sheet piles and use of a splitter into a single category (*i.e.,* vibratory hammer removal) and treated them the same for time (*i.e.,* table 1) and take estimation (see the Estimated Take section).

The POA estimates that an average of approximately 5 minutes of vibratory hammer application would be required to remove sheet pile sections. It is unknown how many sheet piles may be included in a section; the POA anticipates that this number will vary widely. If sheet piles remain seized in the sediments and cannot be loosened or broken free with a vibratory hammer, they may be dislodged with an impact hammer. Use of an impact hammer to dislodge is expected to be uncommon, with up to 150 strikes (an estimated 50 strikes per pile for up to three piles) on any individual day or approximately 5 percent of active hammer duration for each sheet pile. The POA would not use two vibratory hammers with or without splitters simultaneously.

Alternative means of pile removal include dredging or excavation to reduce further pile embedment, and cutting sheet piles using hydraulic shears or underwater ultrathermic cutting. When feasible, sheet piles would be removed in one piece, without cutting. Similarly, use of cutting methods to cut piles into sections that could be more easily removed would take place out of water when feasible. The POA anticipates that hydraulic shears may be used to cut sheet piles both in and out of water. The POA anticipates that sounds produced by hydraulic shears would be brief, low level, and intermittent, imparting minimal sound energy into the water column. A single closure of the shears on sheet pile is anticipated to successfully sever one or multiple sheets depending on the model and jaw depth. The POA anticipates that a single cut may require up to 2 minutes for the shears to close, although the duration of a single cut is likely to be less than 2 minutes. Therefore, take of marine mammals associated with hydraulic shearing is not anticipated or proposed to be authorized.

Underwater ultrathermic cutting is performed by commercial divers using hand-held equipment to cut or melt through ferrous and non-ferrous metals, and could be used to cut the zinc-coated OCSP structure. These systems operate through a torch-like process, initiated by applying a melting amperage to a steel tube packed with alloy steel rods, sometimes mixed with aluminum rods to increase the heat output. In the hands of skilled commercial divers, underwater ultrathermic cutting is reputed to be relatively fast and efficient, cutting through approximately 2 to 4 inches (5 to 10 cm) per minute, depending upon the number of divers deployed. This efficacy may be constrained by the requirement to secure the severed piles from falling into the inlet to prevent an extreme hazard to the diver cutting the piles. Tidally driven currents in Cook Inlet may limit dive times to approximately 2 to 3 hours per high- and low-tide event, depending upon the tide cycle and the ability of divers to efficiently perform the cutting task while holding position during high current periods. Take of marine mammals associated with underwater ultrathermic cutting is not anticipated or proposed to be authorized as this activity is not considered to produce sound.

Once the face sheets have been removed, the crane barge would remove the stability templates for use on other cells. At this point, the tailwalls would become independent walls with only fill material between them. The crane barge would work to extract as many tailwall sheets as possible until additional relief dredging is required to allow for vibratory removal. At this point, the crane barge would continue ahead to the north while the dredge rig falls back to continue dredging between the sheets. The POA would continue to remove the face wall and tailwall sheets from south to north until the OCSP structure has been removed.

A key consideration of the NES1 project is to avoid rapid release of the impounded soils into the inlet. This is an important safety issue presenting a risk to construction personnel working in or near the cells in the immediate area of such an event. It is also an important operational issue to the POA, as releasing large quantities of materials into the inlet could quickly foul the adjoining cargo terminal berths (see Figure 1–7 in the POA's application). To avoid rapid release of the impounded soils, the demolition would need to be managed to account for the soil pressure of the adjacent adjoining cells. Failure to properly manage this process would likely result in the earth pressure generated by adjacent adjoining cells exerting lateral forces that would cause catastrophic tailwall failures. Also, the sheets joined in interlock are susceptible to bending in the weak axis, which could result in rotational forces that may overcome the vertical interlocks, causing the interlocks to unzip, again resulting in catastrophic tailwall failures and or face wall failures. Qualified professional engineers on the Design Build Team would develop the Construction Work Plan with the technical details to ameliorate these risks.

The sheet pile interlocks would not prevent the flow of seawater into soils impounded within the OCSP cells. The water infiltration would be most prevalent at the face sheets; however, dynamic wave forces, the variable sea level height of the inlet, and variations in the impounded soils and associated permeability would make the interface elevation between unsaturated and saturated soils dynamic. Because saturated soils cannot resist shear, land-based excavation could be safely accomplished at a height above the saturated soil depth to be determined by the DOR, lest the equipment weight exceed the soil-bearing capacity.

Shoreline Stabilization

After the existing sheet pile structure has been removed, the sloped shoreline would be secured with armor stone placed on a layer of filter rock and granular fill. Placement of armor rock requires good visibility of the shore as each rock would be placed carefully to interlock with surrounding armor rock. The POA therefore anticipates that placement of armor rock would occur in the dry at low tide levels when feasible; however, some placement of armor rock, filter rock, and granular fill would occur in water. No impacts on marine mammals from placement of armor rock, filter rock, and granular fill in the dry are anticipated and therefore this activity will not be discussed further.

Proposed mitigation, monitoring, and reporting measures are described in detail later in this document (please see Proposed Mitigation and Proposed Monitoring and Reporting).

Description of Marine Mammals in the Area of Specified Activities

There are seven species of marine mammals that may be found in upper Cook Inlet during the proposed construction and demolition activities. Sections 3 and 4 of the IHA application summarize available information regarding status and trends, distribution and habitat preferences, and behavior and life history of the potentially affected species. NMFS fully considered all of this information, and we refer the reader to these descriptions, instead of reprinting the information. Additional information regarding population trends and threats may be found in NMFS' Stock Assessment Reports (SARs; *https://www.fisheries.noaa.gov/national/marine-mammal-protection/marine-mammal-stock-assessments*) and more general information about these species (*e.g.,* physical and behavioral descriptions) may be found on NMFS' website (*https://www.fisheries.noaa.gov/find-species*).

Additional information on CIBWs may be found in NMFS' 2016 Recovery Plan for the CIBW, available online at *https://www.fisheries.noaa.gov/resource/document/recovery-plan-cook-inlet-beluga-whale-delphinapterus-leucas,* and NMFS' 2023 report on the abundance and trend of CIBWs in Cook Inlet in June 2021 and June 2022, available online at *https://www.fisheries.noaa.gov/resource/document/abundance-and-trend-belugas-delphinapterus-leucas-cook-inlet-alaska-june-2021-and.*

Table 4 lists all species or stocks for which take is expected and proposed to be authorized for this activity, and summarizes information related to the population or stock, including regulatory status under the MMPA and Endangered Species Act (ESA) and potential biological removal (PBR), where known. PBR is defined by the MMPA as the maximum number of animals, not including natural mortalities, that may be removed from a marine mammal stock while allowing that stock to reach or maintain its optimum sustainable population (as described in NMFS' SARs). While no serious injury or mortality is anticipated or proposed to be authorized here, PBR and annual serious injury and mortality from anthropogenic sources are included here as gross indicators of the status of the species or stocks and other threats.

Marine mammal abundance estimates presented in this document represent the total number of individuals that make up a given stock or the total number estimated within a particular study or survey area. NMFS' stock abundance estimates for most species represent the total estimate of individuals within the geographic area, if known, that comprises that stock. For some species, this geographic area may extend beyond U.S. waters. All managed stocks in this region are assessed in NMFS' U.S. Alaska and Pacific SARs (*e.g.,* Carretta, *et al.,* 2023; Young *et al.,* 2023). Values presented in Table 4 are the most recent available at the time of publication and are available online at: *https://www.fisheries.noaa.gov/national/marine-mammal-protection/marine-mammal-stock-assessments.* The most recent abundance estimate for CIBWs, however, is available from Goetz *et al.* (2023) and available online at *https://www.fisheries.noaa.gov/feature-story/new-abundance-estimate-endangered-cook-inlet-beluga-whales.*

TABLE 4—SPECIES LIKELY IMPACTED BY THE SPECIFIED ACTIVITIES

Common name	Scientific name	MMPA stock	ESA/MMPA status; strategic (Y/N)[1]	Stock abundance N_{best}, (CV, N_{min}, most recent abundance survey)[2]	PBR	Annual M/SI[3]
Order Cetartiodactyla—Cetacea—Superfamily Mysticeti (baleen whales)						
Family Eschrichtiidae:						
Gray whale	*Eschrichtius robustus*	Eastern N Pacific	-/-; N	26,960 (0.05, 25,849, 2016).	801	131
Family Balaenopteridae (rorquals):						
Humpback whale	*Megaptera novaeangliae*	Hawaii	-, -, N	11,278 (0.56, 7,265, 2020).	127	27.09
		Mexico-North Pacific	T, D, Y	N/A (N/A, N/A, 2006)	[6] UND	0.57
Order Cetartiodactyla—Superfamily Odontoceti (toothed whales, dolphins, and porpoises)						
Family Delphinidae:						
Beluga whale	*Delphinapterus leucas*	Cook Inlet	E/D; Y	[5] 331 (0.076, 290, 2022)	0.53	0
Killer whale	*Orcinus orca*	Eastern North Pacific Alaska Resident.	-/-; N	1,920 (N/A, 1,920, 2019)	19	1.3
		Eastern North Pacific Gulf of Alaska, Aleutian Islands and Bering Sea Transient.	-/-; N	587 (N/A, 587, 2012)	5.9	0.8
Family Phocoenidae (porpoises):						
Harbor porpoise	*Phocoena phocoena*	Gulf of Alaska	-/-; Y	31,046 (0.214, N/A, 1998).	[6] UND	72
Order Carnivora—Superfamily Pinnipedia						
Family Otariidae (eared seals and sea lions):						
Steller sea lion	*Eumetopias jubatus*	Western	E/D; Y	52,932 (N/A, 52,932 2019).	318	255
Family Phocidae (earless seals):						
Harbor seal	*Phoca vitulina*	Cook Inlet/Shelikof Strait	-/-; N	28,411 (N/A, 26,907, 2018).	807	107

[1] Endangered Species Act (ESA) status: Endangered (E), Threatened (T)/MMPA status: Depleted (D). A dash (-) indicates that the species is not listed under the ESA or designated as depleted under the MMPA. Under the MMPA, a strategic stock is one for which the level of direct human-caused mortality exceeds PBR or which is determined to be declining and likely to be listed under the ESA within the foreseeable future. Any species or stock listed under the ESA is automatically designated under the MMPA as depleted and as a strategic stock.

[2] NMFS marine mammal stock assessment reports online at: *https://www.fisheries.noaa.gov/national/marine-mammal-protection/marine-mammal-stock-assessments.* CV is coefficient of variation; Nmin is the minimum estimate of stock abundance. In some cases, CV is not applicable (N.A.).

[3] These values, found in NMFS's SARs, represent annual levels of human-caused mortality plus serious injury from all sources combined (*e.g.,* commercial fisheries, ship strike). Annual M/SI often cannot be determined precisely and is in some cases presented as a minimum value or range. A CV associated with estimated mortality due to commercial fisheries is presented in some cases.

[4] UNK means unknown.

[5] This abundance estimate is from Goetz *et al.* (2023).

[6] UND means undetermined.

On June 15, 2023, NMFS released an updated abundance estimate for endangered CIBWs in Alaska (Goetz *et al.,* 2023) that incorporates aerial survey data from June 2021 and 2022, but which is not included in the most recent SAR (Young *et al.,* 2023). Data collected during NMFS recent aerial survey effort suggest that the whale population is stable or may be increasing slightly. Goetz *et al.* (2023) estimated that the population size is currently between 290 and 386, with a median best estimate of 331. In accordance with the MMPA, this population estimate will be incorporated into the next draft CIBW SAR, which will be reviewed by an independent panel of experts, the Alaska Scientific Review Group. After this review, the SAR will be made available as a draft for public review before being finalized. We have determined that it is appropriate to consider the CIBW estimate of abundance reported by Goetz *et al.* (2023) in our analysis rather than the older estimate currently available from the Alaska SAR (Young *et al.,* 2023) because it is based on the most recent and best available science.

As indicated above, all seven species (with nine managed stocks) in Table 4 temporally and spatially co-occur with the activity to the degree that take is reasonably likely to occur. Minke whales (*Balaenoptera acutorostrata*) and Dall's porpoises (*Phocoenoides dalli*) also occur in Cook Inlet; however, the spatial occurrence of these species is such that take is not expected to occur, and they are not discussed further beyond the explanation provided here. Data from the Alaska Marine Mammal Stranding Network database (NMFS, unpublished data) provide additional support for these determinations. From 2011 to 2020, only one minke whale and one Dall's porpoise were documented as stranded in the portion of Cook Inlet north of Point Possession. Both were dead upon discovery; it is unknown if they were alive upon their entry into upper Cook Inlet or drifted into the area with the tides. With very few exceptions, minke whales and Dall's porpoises do not occur in upper Cook Inlet, and therefore take of these species is considered unlikely.

In addition, sea otters (*Enhydra lutris*) may be found in Cook Inlet. However, sea otters are managed by the U.S. Fish and Wildlife Service (USFWS) and are not considered further in this document.

Gray Whale

The stock structure for gray whales in the Pacific has been studied for a number of years and remains uncertain as of the most recent (2022) Pacific SARs (Carretta *et al.,* 2023). Gray whale population structure is not determined by simple geography and may be in flux due to evolving migratory dynamics (Carretta *et al.,* 2023). Currently, the SARs delineate a western North Pacific (WNP) gray whale stock and an eastern North Pacific (ENP) stock based on genetic differentiation (Carretta *et al.,* 2023). WNP gray whales are not known to feed in or travel to upper Cook Inlet (Conant and Lohe, 2023; Weller *et al.,* 2023). Therefore, we assume that gray whales near the project area are members of the ENP stock.

An Unusual Mortality Event (UME) along the West Coast and in Alaska was declared for gray whales in January 2019 (NMFS, 2022a). Since 2019, 143 gray whales have stranded off the coast of Alaska. Preliminary findings for several of the whales indicate evidence of emaciation, but the UME is still under investigation, and the cause of the mortalities remains unknown (NMFS, 2022a; see *https://www.fisheries.noaa.gov/national/marine-life-distress/2019-2023-gray-whale-unusual-mortality-event-along-west-coast-and* for more information).

Gray whales are infrequent visitors to Cook Inlet, but can be seasonally present during spring and fall in the lower inlet (Bureau of Ocean Energy Management (BOEM), 2021). Migrating gray whales pass through the lower inlet during their spring and fall migrations to and from their primary summer feeding areas in the Bering, Chukchi, and Beaufort seas (Swartz, 2018; Silber *et al.,* 2021; BOEM, 2021).

Gray whales are rarely documented in upper Cook Inlet and in the project area. Gray whales were not documented during POA construction or scientific monitoring from 2005 to 2011 or during 2016 (Prevel-Ramos *et al.,* 2006; Markowitz and McGuire, 2007; Cornick and Saxon-Kendall, 2008, 2009; Cornick *et al.,* 2010, 2011; Integrated Concepts and Research Corporation (ICRC), 2009, 2010, 2011, 2012; Cornick and Pinney, 2011; Cornick and Seagars, 2016); however, one gray whale was observed near Port MacKenzie during 2020 PCT construction (61 North (61N) Environmental, 2021) and a second whale was observed off of Ship Creek during 2021 PCT construction monitoring (61N Environmental, 2022a, Easley-Appleyard and Leonard, 2022). The whale observed in 2020 is believed to be the same whale that later stranded in the Twentymile River, at the eastern end of Turnagain Arm, approximately 80 km southeast of Knik Arm. There was no indication that work at the PCT had any effect on the animal (see *https://www.fisheries.noaa.gov/feature-story/alaska-gray-whale-ume-update-twentymile-river-whale-likely-one-twelve-dead-gray-whales* for more information). No gray whales were observed during POA's transitional dredging or SFD construction monitoring from May to August, 2022 (61N Environmental, 2022b, 2022c).

Humpback Whale

On September 8, 2016, NMFS divided the humpback whales into 14 distinct population segments (DPS) under the ESA, removed the species-level listing as endangered, and, in its place, listed four DPSs as endangered and one DPS as threatened (81 FR 62259, September 8, 2016). The remaining nine DPSs were not listed. There are four DPSs in the North Pacific, including Western North Pacific and Central America, which are listed as endangered, Mexico, which is listed as threatened, and Hawaii, which is not listed.

The 2022 Alaska and Pacific SARs described a revised stock structure for humpback whales which modifies the previous stocks designated under the MMPA to align more closely with the ESA-designated DPSs (Carretta *et al.,* 2023; Young *et al.,* 2023). Specifically, the three previous North Pacific humpback whale stocks (Central and Western North Pacific stocks and a CA/OR/WA stock) were replaced by five stocks, largely corresponding with the ESA-designated DPSs. These include Western North Pacific and Hawaii stocks and a Central America/Southern Mexico-CA/OR/WA stock (which corresponds with the Central America DPS). The remaining two stocks, corresponding with the Mexico DPS, are the Mainland Mexico-CA/OR/WA and Mexico-North Pacific stocks (Carretta *et al.,* 2023; Young *et al.,* 2023). The former stock is expected to occur along the west coast from California to southern British Columbia, while the latter stock may occur across the Pacific, from northern British Columbia through the Gulf of Alaska and Aleutian Islands/Bering Sea region to Russia.

The Hawaii stock consists of one demographically independent population (DIP) (Hawaii—Southeast Alaska/Northern British Columbia DIP) and the Hawaii—North Pacific unit, which may or may not be composed of multiple DIPs (Wade *et al.,* 2021). The DIP and unit are managed as a single stock at this time, due to the lack of data available to separately assess them and lack of compelling conservation benefit to managing them separately (NMFS, 2019, 2022b, 2023). The DIP is delineated based on two strong lines of evidence: genetics and movement data (Wade *et al.,* 2021). Whales in the Hawaii—Southeast Alaska/Northern British Columbia DIP winter off Hawaii and largely summer in Southeast Alaska and Northern British Columbia (Wade *et al.,* 2021). The group of whales that migrate from Russia, western Alaska (Bering Sea and Aleutian Islands), and central Alaska (Gulf of Alaska excluding Southeast Alaska) to Hawaii have been delineated as the Hawaii-North Pacific unit (Wade *et al.,* 2021). There are a small number of whales that migrate between Hawaii and southern British Columbia/Washington, but current data and analyses do not provide a clear understanding of which unit these whales belong to (Wade *et al.,* 2021; Carretta *et al.,* 2023; Young *et al.,* 2023).

The Mexico-North Pacific stock is likely composed of multiple DIPs, based on movement data (Martien *et al.,* 2021; Wade, 2021; Wade *et al.,* 2021). However, because currently available data and analyses are not sufficient to delineate or assess DIPs within the unit, it was designated as a single stock (NMFS, 2019, 2022c, 2023). Whales in this stock winter off Mexico and the Revillagigedo Archipelago and summer primarily in Alaska waters (Martien *et al.,* 2021; Carretta *et al.,* 2023; Young *et al.,* 2023).

The most comprehensive photo-identification data available suggest that approximately 89 percent of all humpback whales in the Gulf of Alaska are members of the Hawaii stock, 11 percent are from the Mexico stock, and less than 1 percent are from the Western North Pacific stock (Wade, 2021). Members of different stocks are known to intermix in feeding grounds.

On October 9, 2019, NMFS proposed to designate critical habitat for the Western North Pacific, Mexico, and Central America DPSs of humpback whales (84 FR 54354). NMFS issued a final rule on April 21, 2021 to designate critical habitat for ESA-listed humpback whales pursuant to Section 4 of the ESA (86 FR 21082). There is no designated critical habitat for humpback whales in or near the Project area (86 FR 21082, April 21, 2021).

Humpback whales are encountered regularly in lower Cook Inlet and occasionally in mid-Cook Inlet; however, sightings are rare in upper Cook Inlet (*e.g.,* Witteveen *et al.,* 2011). During aerial surveys conducted in summers between 2005 and 2012, Shelden *et al.* (2013) reported dozens of sightings in lower Cook Inlet, a handful of sightings in the vicinity of Anchor Point and in lower Cook Inlet, and no sightings north of 60° N latitude. NMFS changed to a biennial survey schedule starting in 2014 after analysis showed there would be little reduction in the ability to detect a trend given the current growth rate of the population (Hobbs, 2013). No survey took place in 2020. Instead, consecutive surveys took place in 2021 and 2022 (Shelden *et al.,* 2022). During the 2014–2022 aerial surveys, sightings of humpback whales were recorded in lower Cook Inlet and mid-Cook Inlet, but none were observed in upper Cook Inlet (Shelden *et al.,* 2015b, 2017, 2019, 2022). Vessel-based observers participating in the Apache Corporation's 2014 survey operations recorded three humpback whale sightings near Moose Point in upper Cook Inlet and two sightings near Anchor Point, while aerial and land-based observers recorded no humpback whale sightings, including in the upper inlet (Lomac-MacNair *et al.,* 2014). Observers monitoring waters between Point Campbell and Fire Island during summer and fall 2011 and spring and summer 2012 recorded no humpback whale sightings (Brueggeman *et al.,* 2013). Monitoring of Turnagain Arm during ice-free months between 2006 and 2014 yielded one humpback whale sighting (McGuire, unpublished data, cited in LGL Alaska Research Associates, Inc., and DOWL, 2015).

There have been few sightings of humpback whales in the vicinity of the proposed project area. Humpback whales were not documented during POA construction or scientific monitoring from 2005 to 2011, in 2016, or during 2020 (Prevel-Ramos *et al.,* 2006; Markowitz and McGuire, 2007; Cornick and Saxon-Kendall, 2008, 2009; Cornick *et al.,* 2010, 2011; ICRC, 2009, 2010, 2011, 2012; Cornick and Pinney, 2011; Cornick and Seagars, 2016; 61N Environmental, 2021). Observers monitoring the Ship Creek Small Boat Launch from August 23 to September 11, 2017 recorded two sightings, each of a single humpback whale, which was presumed to be the same individual (POA, 2017). One other humpback whale sighting has been recorded for the immediate vicinity of the project area. This event involved a stranded whale that was sighted near a number of locations in upper Cook Inlet before washing ashore at Kincaid Park in 2017; it is unclear as to whether the humpback whale was alive or deceased upon entering Cook Inlet waters. Another juvenile humpback stranded in Turnagain Arm in April 2019 near mile 86 of the Seward Highway. One additional humpback whale was observed in July during 2022 transitional dredging monitoring (61N Environmental, 2022c). No humpback whales were observed during the 2020 to 2021 PCT construction monitoring, the NMFS marine mammal monitoring, or the 2022 SFD construction monitoring from April to June (61N Environmental, 2021, 2022a, 2022b, 2022c; Easley-Appleyard and Leonard, 2022).

Beluga Whale

Five stocks of beluga whales are recognized in Alaska: the Beaufort Sea stock, eastern Chukchi Sea stock, eastern Bering Sea stock, Bristol Bay stock, and Cook Inlet stock (Young *et al.,* 2023). The Cook Inlet stock is geographically and genetically isolated from the other stocks (O'Corry-Crowe *et al.,* 1997; Laidre *et al.,* 2000) and resides year-round in Cook Inlet (Laidre *et al.,* 2000; Castellote *et al.,* 2020). Only the Cook Inlet stock (CIBWs) inhabits the proposed project area. CIBWs were designated as a DPS and listed as endangered under the ESA in October 2008 (73 FR 62919, October 10, 2008).

Shelden and Wade (2019) analyzed time-series CIBW abundance data from 2008 to 2018 and reported that the CIBW population was declining at an annual rate of 2.3 percent during this time. Goetz *et al.,* (2023) suggest that this decline could have been part of a natural oscillation in the population or possibly due to impacts of the unprecedented heatwave in the Gulf of Alaska during the same time period. The CIBW time-series abundance data were analyzed using a Bayesian statistical method to estimate group size for calculating CIBW abundance. This method produced an abundance estimate of 279 CIBWs, with a 95 percent probability range of 250 to 317 whales (Shelden and Wade, 2019).

In June 2023, NMFS released an updated abundance estimate for CIBWs in Alaska that incorporates aerial survey data from June 2021 and 2022 and accounted for visibility bias (*i.e.,* availability bias due to diving behavior; proximity bias due to individuals concealed by another individual in the video data; perception bias due to individuals not detected because of small image size in the video data; and individual observer bias in visual observer data) (Goetz *et al.,* 2023). This report estimated that CIBW abundance is between 290 and 386, with a median best estimate of 331. Goetz *et al.* (2023) also present an analysis of population trends for the most recent 10-year period (2012–2022). The addition of data from the 2021 and 2022 survey years in the analysis resulted in a 65.1 percent probability that the CIBW population is now increasing at 0.9 percent per year (95 percent prediction interval of −3 to 5.7 percent). This increase drops slightly to 0.2 percent per year (95 percent prediction interval of −1.8 to 2.6 percent) with a 60 percent probability that the CIBW population is increasing more than 1 percent per year when data from 2021, which had limited survey coverage due to poor weather, are excluded from the analysis. Median group size estimates in 2021 and 2022 were 34 and 15, respectively (Goetz *et al.,* 2023). For management purposes, NMFS has determined that the carrying capacity of Cook Inlet is 1,300 CIBWs (65 FR 34590, May 31, 2000) based on historical CIBW abundance estimated by Calkins (1989).

Live stranding events of CIBWs have been regularly observed in upper Cook Inlet. This can occur when an individual or group of individuals strands as the tide recedes. Most live strandings have occurred in Knik Arm and Turnagain Arm, which are shallow and have large tidal ranges, strong currents, and extensive mudflats. Most whales involved in a live stranding event survive, although some associated deaths may not be observed if the whales die later from live-stranding-related injuries (Vos and Shelden, 2005; Burek-Huntington *et al.,* 2015). Between 2014 and 2018, there were reports of approximately 79 CIBWs involved in three known live stranding events, plus one suspected live stranding event with two associated deaths reported (NMFS, 2016b; NMFS, unpublished data; Muto *et al.,* 2020). In 2014, necropsy results from two whales found in Turnagain Arm suggested that a live stranding event contributed to their deaths as both had aspirated mud and water. No live stranding events were reported prior to the discovery of these dead whales, suggesting that not all live stranding events are observed.

Another source of CIBW mortality in Cook Inlet is predation by transient-type (mammal-eating) killer whales (NMFS, 2016b; Shelden *et al.,* 2003). No human-caused mortality or serious injury of CIBWs through interactions with commercial, recreational, and subsistence fisheries, takes by subsistence hunters, and or human-caused events (*e.g.,* entanglement in marine debris, ship strikes) has been recently documented and harvesting of CIBWs has not occurred since 2008 (NMFS, 2008b).

Recovery Plan. In 2010, a Recovery Team, consisting of a Science Panel and Stakeholder Panel, began meeting to develop a Recovery Plan for the CIBW. The Final Recovery Plan was published in the **Federal Register** on January 5, 2017 (82 FR 1325). In September 2022, NMFS completed the ESA 5-year review for the CIBW DPS and determined that the CIBW DPS should remain listed as endangered (NMFS, 2022d).

In its Recovery Plan (82 FR 1325, January 5, 2017), NMFS identified several potential threats to CIBWs, including: (1) high concern: catastrophic events (*e.g.,* natural disasters, spills, mass strandings), cumulative effects of multiple stressors, and noise; (2) medium concern: disease agents (*e.g.,* pathogens, parasites, and harmful algal blooms), habitat loss or degradation, reduction in prey, and unauthorized take; and (3) low concern: pollution, predation, and subsistence harvest. The recovery plan did not treat climate change as a distinct threat but rather as a consideration in the threats of high and medium concern. Other potential threats most likely to result in direct human-caused mortality or serious injury of this stock include vessel strikes.

Critical Habitat. On April 11, 2011, NMFS designated two areas of critical habitat for CIBW (76 FR 20179). The designation includes 7,800 km^2 of marine and estuarine habitat within Cook Inlet, encompassing approximately 1,909 km^2 in Area 1 and 5,891 km^2 in Area 2 (see Figure 1 in 76 FR 20179). Area 1 of the CIBW critical habitat encompasses all marine waters of Cook Inlet north of a line connecting Point Possession (lat. 61.04° N, long. 150.37° W) and the mouth of Three Mile Creek (lat. 61.08.55° N, long. 151.04.40° W), including waters of the Susitna, Little Susitna, and Chickaloon Rivers below mean higher high water. From spring through fall, Area 1 critical habitat has the highest concentration of CIBWs due to its important foraging and calving habitat. Area 2 critical habitat has a lower concentration of CIBWs in spring and summer but is used by CIBWs in fall and winter. Critical habitat does not include two areas of military usage: the Eagle River Flats Range on Fort Richardson and military lands of JBER between Mean Higher High Water and MHW. Additionally, the POA, adjacent navigation channel, and turning basin were excluded from critical habitat designation due to national security reasons (76 FR 20180, April 11, 2011). The POA exclusion area is within Area 1, however, marine mammal monitoring results from the POA suggest that this exclusion area is not a particularly important feeding or calving area. CIBWs have been occasionally documented to forage around Ship Creek (south of the POA) but are typically transiting through the area to other, potentially richer, foraging areas to the north (*e.g.,* Six Mile Creek, Eagle River, Eklutna River) (*e.g.,* 61N Environmental, 2021, 2022a, 2022b, 2022c, Easley-Appleyard and Leonard, 2022). These locations contain predictable salmon runs, an important food source for CIBWs, and the timing of these runs has been correlated with CIBW movements into the upper reaches of Knik Arm (Ezer *et al.,* 2013). More information on CIBW critical habitat can be found at *https://www.fisheries.noaa.gov/action/critical-habitat-cook-inlet-beluga-whale.*

The designation identified the following Primary Constituent Elements, essential features important to the conservation of the CIBW:

(1) Intertidal and subtidal waters of Cook Inlet with depths of less than 9 m (MLLW) and within 8 km of high- and medium-flow anadromous fish streams;

(2) Primary prey species, including four of the five species of Pacific salmon (chum (*Oncorhynchus keta*), sockeye (*Oncorhynchus nerka*), Chinook (*Oncorhynchus tshawytscha*), and coho (*Oncorhynchus kisutch*)), Pacific eulachon (*Thaleichthys pacificus*), Pacific cod (*Gadus macrocephalus*), walleye Pollock (*Gadus chalcogrammus*), saffron cod (*Eleginus gracilis*), and yellowfin sole (*Limanda aspera*);

(3) The absence of toxins or other agents of a type or amount harmful to CIBWs;

(4) Unrestricted passage within or between the critical habitat areas; and

(5) The absence of in-water noise at levels resulting in the abandonment of habitat by CIBWs.

Biologically Important Areas. Wild *et al.* (2023) delineated portions of Cook Inlet, including near the proposed project area, as a Biologically Important Area (BIA) for the small and resident population of CIBWs based on scoring methods outlined by Harrison *et al.* (2023) (see *https://oceannoise.noaa.gov/biologically-important-areas* for more information). The BIA is used year-round by CIBWs for feeding and breeding, and there are limits on food supply such as salmon runs and seasonal movement of other fish species (Wild *et al.,* 2023). The boundary of the CIBW BIA is consistent with NMFS' critical habitat designation, and does not include the aforementioned exclusion areas (*e.g.,* the POA and surrounding waters) (Wild *et al.,* 2023).

Foraging Ecology. CIBWs feed on a wide variety of prey species, particularly those that are seasonally abundant. From late spring through summer, most CIBW stomachs sampled contained salmon, which corresponded to the timing of fish runs in the area. Anadromous smolt and adult fish aggregate at river mouths and adjacent intertidal mudflats (Calkins, 1989). All five Pacific salmon species (*i.e.,* Chinook, pink (*Oncorhynchus gorbuscha*), coho, sockeye, and chum) spawn in rivers throughout Cook Inlet (Moulton, 1997; Moore *et al.,* 2000). Overall, Pacific salmon represent the highest percent frequency of occurrence of prey species in CIBW stomachs. This suggests that their spring feeding in upper Cook Inlet, principally on fat-rich fish such as salmon and eulachon, is important to the energetics of these animals (NMFS, 2016b).

The nutritional quality of Chinook salmon in particular is unparalleled, with an energy content four times greater than that of a Coho salmon. It is suggested the decline of the Chinook salmon population has left a nutritional void in the diet of the CIBWs that no other prey species can fill in terms of quality or quantity (Norman *et al.,* 2020, 2022).

In fall, as anadromous fish runs begin to decline, CIBWs return to consume fish species (cod and bottom fish) found in nearshore bays and estuaries. Stomach samples from CIBWs are not available for winter (December through

March), although dive data from CIBWs tagged with satellite transmitters suggest that they feed in deeper waters during winter (Hobbs *et al.,* 2005), possibly on such prey species as flatfish, cod, sculpin, and pollock.

Distribution in Cook Inlet. The CIBW stock remains within Cook Inlet throughout the year, showing only small seasonal shifts in distribution (Goetz *et al.,* 2012a; Lammers *et al.,* 2013; Castallotte *et al.,* 2015; Shelden *et al.,* 2015a, 2018; Lowery *et al.,* 2019). During spring and summer, CIBWs generally aggregate near the warmer waters of river mouths where prey availability is high and predator occurrence is low (Moore *et al.,* 2000; Shelden and Wade, 2019; McGuire *et al.,* 2020). In particular, CIBW groups are seen in the Susitna River Delta, the Beluga River and along the shore to the Little Susitna River, Knik Arm, and along the shores of Chickaloon Bay. Small groups were recorded farther south in Kachemak Bay, Redoubt Bay (Big River), and Trading Bay (McArthur River) prior to 1996, but rarely thereafter. Since the mid-1990s, most CIBWs (96 to 100 percent) aggregate in shallow areas near river mouths in upper Cook Inlet, and they are only occasionally sighted in the central or southern portions of Cook Inlet during summer (Hobbs *et al.,* 2008). Almost the entire population can be found in northern Cook Inlet from late spring through the summer and into the fall (Muto *et al.,* 2020).

Data from tagged whales (14 tags deployed July 2000 through March 2003) show that CIBWs use upper Cook Inlet intensively between summer and late autumn (Hobbs *et al.,* 2005). CIBWs tagged with satellite transmitters continue to use Knik Arm, Turnagain Arm, and Chickaloon Bay as late as October, but some range into lower Cook Inlet to Chinitna Bay, Tuxedni Bay, and Trading Bay (McArthur River) in fall (Hobbs *et al.,* 2005, 2012). From September through November, CIBWs move between Knik Arm, Turnagain Arm, and Chickaloon Bay (Hobbs *et al.,* 2005; Goetz *et al.,* 2012b). By December, CIBWs are distributed throughout the upper to mid-inlet. From January into March, they move as far south as Kalgin Island and slightly beyond in central offshore waters. CIBWs make occasional excursions into Knik Arm and Turnagain Arm in February and March in spite of ice cover (Hobbs *et al.,* 2005). Although tagged CIBWs move widely around Cook Inlet throughout the year, there is no indication of seasonal migration in and out of Cook Inlet (Hobbs *et al.,* 2005). Data from NMFS aerial surveys, opportunistic sighting reports, and corrected satellite-tagged CIBWs confirm that they are more widely dispersed throughout Cook Inlet during winter (November–April), with animals found between Kalgin Island and Point Possession. Generally fewer observations of CIBWs are reported from the Anchorage and Knik Arm area from November through April (76 FR 20179, April 11, 2011; Rugh *et al.,* 2000, 2004).

The NMFS Marine Mammal Lab has conducted long-term passive acoustic monitoring demonstrating seasonal shifts in CIBW concentrations throughout Cook Inlet. Castellote *et al.* (2015) conducted long-term acoustic monitoring at 13 locations throughout Cook Inlet between 2008 and 2015: North Eagle Bay, Eagle River Mouth, South Eagle Bay, Six Mile, Point MacKenzie, Cairn Point, Fire Island, Little Susitna, Beluga River, Trading Bay, Kenai River, Tuxedni Bay, and Homer Spit; the former six stations being located within Knik Arm. In general, the observed seasonal distribution is in accordance with descriptions based on aerial surveys and satellite telemetry: CIBW detections are higher in the upper inlet during summer, peaking at Little Susitna, Beluga River, and Eagle Bay, followed by fewer detections at those locations during winter. Higher detections in winter at Trading Bay, Kenai River, and Tuxedni Bay suggest a broader CIBW distribution in the lower inlet during winter.

Goetz *et al.* (2012b) modeled habitat preferences using NMFS' 1994–2008 June abundance survey data. In large areas, such as the Susitna Delta (Beluga to Little Susitna Rivers) and Knik Arm, there was a high probability that CIBWs were in larger groups. CIBW presence and acoustic foraging behavior also increased closer to rivers with Chinook salmon runs, such as the Susitna River (*e.g.,* Castellote *et al.,* 2021). Movement has been correlated with the peak discharge of seven major rivers emptying into Cook Inlet. Boat-based surveys from 2005 to the present (McGuire and Stephens, 2017) and results from passive acoustic monitoring across the entire inlet (Castellote *et al.,* 2015) also support seasonal patterns observed with other methods. Based on long-term passive acoustic monitoring, seasonally, foraging behavior was more prevalent during summer, particularly at upper inlet rivers, than during winter. Foraging index was highest at Little Susitna, with a peak in July-August and a secondary peak in May, followed by Beluga River and then Eagle Bay; monthly variation in the foraging index indicates CIBWs shift their foraging behavior among these three locations from April through September.

CIBWs are believed to mostly calve in the summer, and concurrently breed between late spring and early summer (NMFS, 2016b), primarily in upper Cook Inlet. The only known observed occurrence of calving occurred on July 20, 2015, in the Susitna Delta area (T. McGuire, personal communication, March 27, 2017). The first neonates encountered during each field season from 2005 through 2015 were always seen in the Susitna River Delta in July. The photographic identification team's documentation of the dates of the first neonate of each year indicate that calving begins in mid-late July/early August, generally coinciding with the observed timing of annual maximum group size. Probable mating behavior of CIBWs was observed in April and May of 2014, in Trading Bay. Young CIBWs are nursed for 2 years and may continue to associate with their mothers for a considerable time thereafter (Colbeck *et al.,* 2013). Important calving grounds are thought to be located near the river mouths of upper Cook Inlet.

Presence in Project Area. Knik Arm is one of three areas in upper Cook Inlet where CIBWs are concentrated during spring, summer, and early fall. Most CIBWs observed in or near the POA are transiting between upper Knik Arm and other portions of Cook Inlet, and the POA itself is not considered high-quality foraging habitat. CIBWs tend to follow their anadromous prey and travel in and out of Knik Arm with the tides. The predictive habitat model derived by Goetz *et al.* (2012a) indicated that CIBW density ranges from 0 to 1.12 whales per km^2 in Cook Inlet. The highest predicted densities of CIBWs are in Knik Arm, near the mouth of the Susitna River, and in Chickaloon Bay. The model suggests that the density of CIBWs at the mouth of Knik Arm, near the POA, ranges between approximately 0.013 and 0.062 whales per km^2. The distribution presented by Goetz *et al.* (2012a) is generally consistent with CIBW distribution documented in upper Cook Inlet throughout ice-free months (NMFS, 2016b).

Several marine mammal monitoring programs and studies have been conducted at or near the POA during the last 17 years. These studies offer some of the best available information on the presence of CIBWs in the proposed project area. Studies that occurred prior to 2020 are summarized in Section 4.5.5 of the POA's application. More recent programs, which most accurately portray current information regarding CIBW presence in the proposed project area, are summarized here.

PCT Construction Monitoring (2020–2021). A marine mammal monitoring program was implemented during construction of the PCT in 2020 (Phase 1) and 2021 (Phase 2), as required by the NMFS IHAs (85 FR 19294, April 6, 2020). PCT Phase 1 construction included impact installation of 48-inch (122-cm) attenuated piles; impact installation of 36-inch (91-cm) and 48-inch (122-cm) unattenuated piles; vibratory installation of 24-inch (61-cm), 36-inch (91-cm), and 48-inch (122 cm) attenuated and unattenuated piles; and vibratory installation of an unattenuated 72-inch (183-cm) bubble curtain across 95 days. PCT Phase 2 construction included vibratory installation of 36-inch (91-cm) attenuated piles and impact and vibratory installation of 144-inch (366-cm) attenuated breasting and mooring dolphins across 38 days. Marine mammal monitoring in 2020 occurred during 128 non-consecutive days, with a total of 1,238.7 hours of monitoring from April 27 to November 24, 2020 (61N Environmental, 2021). Marine mammal monitoring in 2021 occurred during 74 non-consecutive days, with a total of 734.9 hours of monitoring from April 26 to June 24 and September 7 to 29, 2021 (61N Environmental, 2022a). A total of 1,504 individual CIBWs across 377 groups were sighted during PCT construction monitoring. Sixty-five and sixty-seven percent of CIBW observations occurred on non-pile driving days or before pile driving occurred on a given day during PCT Phase 1 and PCT Phase 2 construction, respectively.

The monitoring effort and data collection were conducted before, during, and after pile driving activities from four locations as stipulated by the PCT IHAs (85 FR 19294, April 6, 2020): (1) the Anchorage Public Boat Dock by Ship Creek, (2) the Anchorage Downtown Viewpoint near Point Woronzof, (3) the PCT construction site, and (4) the North End (North Extension) at the north end of the POA, near Cairn Point. Marine mammal sighting data from April to September both before, during, and after pile driving indicate that CIBWs swam near the POA and lingered there for periods of time ranging from a few minutes to a few hours. CIBWs were most often seen traveling at a slow or moderate pace, either from the north near Cairn Point or from the south or milling at the mouth of Ship Creek. Groups of CIBWs were also observed swimming north and south in front of the PCT construction, and did not appear to exhibit avoidance behaviors either before, during, or after pile driving activities (61N Environmental, 2021, 2022a). CIBW sightings in June were concentrated on the west side of Knik Arm from the Little Susitna River Delta to Port MacKenzie. From July through September, CIBWs were most often seen milling and traveling on the east side of Knik Arm from Point Woronzof to Cairn Point (61N Environmental, 2021, 2022a).

SFD Construction Monitoring and Transitional Dredging (2022). In 2022, a marine mammal monitoring program almost identical to that used during PCT construction was implemented during construction of the SFD, as required by the NMFS IHA (86 FR 50057, September 7, 2021). SFD construction included the vibratory installation of ten 36-inch (91-cm) attenuated plumb piles and two unattenuated battered piles (61N Environmental, 2022b). Marine mammal monitoring was conducted during 13 non-consecutive days, with a total of 108.2 hours of monitoring observation from May 20 through June 11, 2022 (61N Environmental, 2022b). Forty-one individual CIBWs across 9 groups were sighted (61N Environmental, 2022b). One group was observed on a day with no pile-driving, three groups were seen on days before pile driving activities started, and five groups were seen during vibratory pile driving activities (61N Environmental, 2022b).

During SFD construction, the position of the Ship Creek monitoring station was adjusted to allow monitoring of a portion of the shoreline north of Cairn Point that could not be seen by the station at the northern end of the POA (61N Environmental, 2022b). Eleven protected species observers (PSOs) worked from four monitoring stations located along a 9-km (6-mi) stretch of coastline surrounding the POA. The monitoring effort and data collection were conducted at the following four locations: (1) Point Woronzof approximately 6.5 km (4 mi) southwest of the SFD, (2) the promontory near the boat launch at Ship Creek, (3) the SFD project site, and (4) the northern end of the POA (61N Environmental, 2022b).

Ninety groups comprised of 529 CIBWs were also sighted during the transitional dredging monitoring that occurred from May 3 to 15, 2022 and June 27 to August 24, 2022 (61N Environmental, 2022b). Of the nine groups of CIBWs sighted during SFD construction, traveling was recorded as the primary behavior for each group (61N Environmental, 2022b). CIBWs traveled and milled between the SFD construction area, Ship Creek, and areas to the south of the POA for more than an hour at a time, delaying some construction activities.

Killer Whale

Along the west coast of North America, seasonal and year-round occurrence of killer whales has been noted along the entire Alaska coast (Braham and Dahlheim, 1982), in British Columbia and Washington inland waterways (Bigg *et al.,* 1990), and along the outer coasts of Washington, Oregon, and California (Green *et al.,* 1992; Barlow 1995, 1997; Forney *et al.,* 1995). Killer whales from these areas have been labeled as ''resident,'' ''transient,'' and ''offshore'' type killer whales (Bigg *et al.,* 1990; Ford *et al.,* 2000; Dahlheim *et al.,* 2008) based on aspects of morphology, ecology, genetics, and behavior (Ford and Fisher, 1982; Baird and Stacey, 1988; Baird *et al.,* 1992; Hoelzel *et al.,* 1998, 2002; Barrett Lennard, 2000; Dahlheim *et al.,* 2008). Based on data regarding association patterns, acoustics, movements, and genetic differences, eight killer whale stocks are now recognized within the U.S. Pacific, two of which have the potential to be found in the proposed project area: the Eastern North Pacific Alaska Resident stock and the Gulf of Alaska, Aleutian Islands, and the Bering Sea Transient stock. Both stocks overlap the same geographic area; however, they maintain social and reproductive isolation and feed on different prey species. Resident killer whales are primarily fish-eaters, while transients primarily hunt and consume marine mammals, such as harbor seals, Dall's porpoises, harbor porpoises, beluga whales and sea lions. Killer whales are not harvested for subsistence in Alaska. Potential threats most likely to result in direct human-caused mortality or serious injury of killer whales in this region include oil spills, vessel strikes, and interactions with fisheries.

Killer whales are rare in Cook Inlet, and most individuals are observed in lower Cook Inlet (Shelden *et al.,* 2013). The infrequent sightings of killer whales that are reported in upper Cook Inlet tend to occur when their primary prey (anadromous fish for resident killer whales and beluga whales for transient killer whales) are also in the area (Shelden *et al.,* 2003). During CIBW aerial surveys between 1993 and 2012, killer whales were sighted in lower Cook Inlet 17 times, with a total of 70 animals (Shelden *et al.,* 2013); no killer whales were observed in upper Cook Inlet during this time. Surveys over 20 years by Shelden *et al.* (2003) documented an increase in CIBW sightings and strandings in upper Cook Inlet beginning in the early 1990s. Several of these sightings and strandings reported evidence of killer whale predation on CIBWs. The pod sizes of killer whales preying on CIBWs ranged from one to six individuals (Shelden *et al.,* 2003). Passive acoustic monitoring efforts throughout Cook Inlet documented killer whales at the Beluga River, Kenai River, and Homer Spit, although they were not encountered within Knik Arm (Castellote *et al.,* 2016). These detections were likely resident killer whales. Transient killer whales likely have not been acoustically detected due to their propensity to move quietly through waters to track prey (Small, 2010; Lammers *et al.,* 2013).

Few killer whales, if any, are expected to approach or be in the vicinity of the proposed project area. No killer whales were spotted in the vicinity of the POA during surveys by Funk *et al.* (2005), Ireland *et al.* (2005), or Brueggeman *et al.* (2007, 2008a, 2008b). Killer whales have also not been documented during any POA construction or scientific monitoring from 2005 to 2011, in 2016, or in 2020 (Prevel-Ramos *et al.,* 2006; Markowitz and McGuire, 2007; Cornick and Saxon-Kendall, 2008; ICRC, 2009, 2010, 2011, 2012; Cornick *et al.,* 2010, 2011; Cornick and Pinney, 2011; Cornick and Seagars, 2016; 61N Environmental, 2021). Two killer whales, one male and one juvenile of unknown sex, were sighted offshore of Point Woronzof in September 2021 during PCT Phase 2 construction monitoring (61N Environmental, 2022a). The pair of killer whales moved up Knik Arm, reversed direction near Cairn Point, and moved southwest out of Knik Arm toward the open water of Upper Cook Inlet. No killer whales were sighted during the 2021 NMFS marine mammal monitoring or the 2022 transitional dredging and SFD construction monitoring that occurred between May and June 2022 (61N Environmental, 2022b, 2022c; Easley-Appleyard and Leonard, 2022).

Harbor Porpoise

In the eastern North Pacific Ocean, harbor porpoise range from Point Barrow, along the Alaska coast, and down the west coast of North America to Point Conception, California. The 2022 Alaska SARs describe a revised stock structure for harbor porpoises (Young *et al.,* 2023). Previously, NMFS had designated three stocks of harbor porpoises: the Bering Sea stock, the Gulf of Alaska stock, and the Southeast Alaska stock (Muto *et al.,* 2022; Zerbini *et al.,* 2022). The 2022 Alaska SARs splits the Southeast Alaska stock into three separate stocks, resulting in five separate stocks in Alaskan waters for this species. This update better aligns harbor porpoise stock structure with genetics, trends in abundance, and information regarding discontinuous distribution trends (Young *et al.,* 2023). Harbor porpoises found in Cook Inlet are assumed to be members of the Gulf of Alaska stock (Young *et al.,* 2023).

Harbor porpoises occur most frequently in waters less than 100 m deep (Hobbs and Waite, 2010). They can be opportunistic foragers but consume primarily schooling forage fish (Bowen and Siniff, 1999). Given their shallow water distribution, harbor porpoise are vulnerable to physical modifications of nearshore habitats resulting from urban and industrial development (including waste management and nonpoint source runoff) and activities such as construction of docks and other over-water structures, filling of shallow areas, dredging, and noise (Linnenschmidt *et al.,* 2013). Subsistence users have not reported any harvest from the Gulf of Alaska harbor porpoise stock since the early 1900s (Shelden *et al.,* 2014). Calving occurs from May to August; however, this can vary by region. Harbor porpoises are often found traveling alone, or in small groups of less than 10 individuals (Schmale, 2008).

Harbor porpoises occur throughout Cook Inlet, with passive acoustic detections being more prevalent in lower Cook Inlet. Although harbor porpoises have been frequently observed during aerial surveys in Cook Inlet (Shelden *et al.,* 2014), most sightings are of single animals and are concentrated at Chinitna and Tuxedni bays on the west side of lower Cook Inlet (Rugh *et al.,* 2005). The occurrence of larger numbers of porpoise in the lower Cook Inlet may be driven by greater availability of preferred prey and possibly less competition with CIBWs, as CIBWs move into upper inlet waters to forage on Pacific salmon during the summer months (Shelden *et al.,* 2014).

An increase in harbor porpoise sightings in upper Cook Inlet was observed over recent decades (*e.g.,* 61N Environmental, 2021, 2022a; Shelden *et al.,* 2014). Small numbers of harbor porpoises have been consistently reported in upper Cook Inlet between April and October (Prevel-Ramos *et al.,* 2008). The overall increase in the number of harbor porpoise sightings in upper Cook Inlet is unknown, although it may be an artifact from increased studies and marine mammal monitoring programs in upper Cook Inlet. It is also possible that the contraction in the CIBW's range has opened up previously occupied CIBW range to harbor porpoises (Shelden *et al.,* 2014).

Harbor porpoises have been observed within Knik Arm during monitoring efforts from 2005 to 2016. Between April 27 and November 24, 2020, 18 harbor porpoises were observed near the POA during the PCT Phase 1 construction monitoring (61N Environmental, 2021). Twenty-seven harbor porpoises were observed near the POA during the PCT Phase 2 construction monitoring conducted between April 26 and September 29, 2021 (61N Environmental, 2022a). During NMFS marine mammal monitoring conducted in 2021, one harbor porpoise was observed in August and six harbor porpoises were observed in October (Easley-Appleyard and Leonard, 2022). During 2022, five harbor porpoises were sighted during transitional dredging monitoring (61N Environmental, 2022c). No harbor porpoises were sighted at the POA during the 2022 SFD construction monitoring that occurred between May and June 2022 (61N Environmental, 2022b).

Steller Sea Lion

Two Distinct Population Segments (DPSs) of Steller sea lion occur in Alaska: the western DPS and the eastern DPS. The western DPS includes animals that occur west of Cape Suckling, Alaska, and therefore includes individuals within the Project area. The western DPS was listed under the ESA as threatened in 1990 (55 FR 49204, November 26, 1990), and its continued population decline resulted in a change in listing status to endangered in 1997 (62 FR 24345, May 5, 1997). Since 2000, studies indicate that the population east of Samalga Pass (*i.e.,* east of the Aleutian Islands) has increased and is potentially stable (Young *et al.,* 2023).

There is uncertainty regarding threats currently impeding the recovery of Steller sea lions, particularly in the Aleutian Islands. Many factors have been suggested as causes of the steep decline in abundance of western Steller sea lions observed in the 1980s, including competitive effects of fishing, environmental change, disease, contaminants, killer whale predation, incidental take, and illegal and legal shooting (Atkinson *et al.,* 2008; NMFS, 2008a). A number of management actions have been implemented since 1990 to promote the recovery of the Western U.S. stock of Steller sea lions, including 5.6-km (3-nautical mile) no-entry zones around rookeries, prohibition of shooting at or near sea lions, and regulation of fisheries for sea lion prey species (*e.g.,* walleye pollock, Pacific cod, and Atka mackerel (*Pleurogrammus monopterygius*)) (Sinclair *et al.,* 2013; Tollit *et al.,* 2017). Additionally, potentially deleterious events, such as harmful algal blooms

(Lefebvre *et al.,* 2016) and disease transmission across the Arctic (VanWormer *et al.,* 2019) that have been associated with warming waters, could lead to potentially negative population-level impacts on Steller sea lions.

NMFS designated critical habitat for Steller sea lions on August 27, 1993 (58 FR 45269). The critical habitat designation for the Western DPS of was determined to include a 37-km (20-nautical mile) buffer around all major haul-outs and rookeries, and associated terrestrial, atmospheric, and aquatic zones, plus three large offshore foraging areas, none of which occurs in the project area.

Steller sea lions are opportunistic predators, feeding primarily on a wide variety of seasonally abundant fishes and cephalopods, including Pacific herring (*Clupea pallasi*), walleye pollock, capelin (*Mallotus villosus*), Pacific sand lance (*Ammodytes hexapterus*), Pacific cod, salmon (*Oncorhynchus spp.*), and squid (*Teuthida spp.*); (Jefferson *et al.,* 2008; Wynne *et al.,* 2011). Steller sea lions do not generally eat every day, but tend to forage every 1–2 days and return to haulouts to rest between foraging trips (Merrick and Loughlin, 1997; Rehberg *et al.,* 2009). Steller sea lions feed largely on walleye pollock, salmon, and arrowtooth flounder during the summer, and walleye pollock and Pacific cod during the winter (Sinclair and Zeppelin, 2002). Except for salmon, none of these are found in abundance in upper Cook Inlet (Nemeth *et al.,* 2007).

Within Cook Inlet, Steller sea lions primarily inhabit lower Cook Inlet. However, they occasionally venture to upper Cook Inlet and Knik Arm and may be attracted to salmon runs in the region. Steller sea lions have not been documented in upper Cook Inlet during CIBW aerial surveys conducted annually in June from 1994 through 2012 and in 2014 (Shelden *et al.,* 2013, 2015b, 2017; Shelden and Wade, 2019); however, there has been an increase in individual Steller sea lion sightings near the POA in recent years.

Steller sea lions were observed near the POA in 2009, 2016, and 2019 through 2022 (ICRC, 2009; Cornick and Seagars, 2016; POA, 2019; 61N Environmental, 2021, 2022a, 2022b, 2022c). In 2009, there were three Steller sea lion sightings that were believed to be the same individual (ICRC, 2009). In 2016, Steller sea lions were observed on 2 separate days. On May 2, 2016, one individual was sighted, while on May 25, 2016, there were five Steller Sea lion sightings within a 50-minute period, and these sightings occurred in areas relatively close to one another (Cornick and Seagars, 2016). Given the proximity in time and space, it is believed these five sightings were of the same individual sea lion. In 2019, one Steller sea lion was observed in June at the POA during transitional dredging (POA, 2019). There were six sightings of individual Steller sea lions near the POA during PCT Phase 1 construction monitoring (61N Environmental, 2021). At least two of these sightings may have been re-sights on the same individual. An additional seven unidentified pinnipeds were observed that could have been Steller sea lions or harbor seals (61N Environmental, 2021). In 2021, there were a total of eight sightings of individual Steller sea lions observed near the POA during PCT Phase 2 construction monitoring (61N Environmental, 2022a). During NMFS marine mammal monitoring, one Steller sea lion was observed in August 2021 in the middle of the inlet (Easley-Appleyard and Leonard, 2022). In 2022, there were three Steller sea lion sightings during the transitional dredging monitoring and three during SFD construction monitoring (61N Environmental, 2022b, 2022c). All sightings occurred during summer, when the sea lions were likely attracted to ongoing salmon runs. Sea lion observations near the POA may be increasing due to more consistent observation effort or due to increased presence; observations continue to be occasional.

Harbor Seal

Harbor seals inhabit waters all along the western coast of the United States, British Columbia, and north through Alaska waters to the Pribilof Islands and Cape Newenham. NMFS currently identifies 12 stocks of harbor seals in Alaska based largely on genetic structure (Young *et al.,* 2023). Harbor seals in the proposed project area are members of the Cook Inlet/Shelikof stock, which ranges from the southwest tip of Unimak Island east along the southern coast of the Alaska Peninsula to Elizabeth Island off the southwest tip of the Kenai Peninsula, including Cook Inlet, Knik Arm, and Turnagain Arm. Distribution of the Cook Inlet/Shelikof stock extends from Unimak Island, in the Aleutian Islands archipelago, north through all of upper and lower Cook Inlet (Young *et al.,* 2023).

Harbor seals forage in marine, estuarine, and occasionally freshwater habitat. They are opportunistic feeders that adjust their local distribution to take advantage of locally and seasonally abundant prey (Baird, 2001; Bjørge, 2002). In Cook Inlet, harbor seals have been documented in higher concentrations near steelhead (*Oncorhynchus mykiss*), Chinook, and salmon spawning streams during summer and may target more offshore prey species during winter (Boveng *et al.,* 2012).

Harbor seals haul out on rocks, reefs, beaches, and drifting glacial ice (Young *et al.,* 2023). Their movements are influenced by tides, weather, season, food availability, and reproduction, as well as individual sex and age class (Lowry *et al.,* 2001; Small *et al.,* 2003; Boveng *et al.,* 2012). The results of past and recent satellite tagging studies in Southeast Alaska, Prince William Sound, Kodiak Island, and Cook Inlet are also consistent with the conclusion that harbor seals are non-migratory (Lowry *et al.,* 2001; Small *et al.,* 2003; Boveng *et al.,* 2012). However, some long-distance movements of tagged animals in Alaska have been recorded (Pitcher and McAllister, 1981; Lowry *et al.,* 2001; Small *et al.,* 2003; Womble, 2012; Womble and Gende, 2013). Strong fidelity of individuals for haul-out sites during the breeding season has been documented in several populations (Härkönen and Harding, 2001), including some regions in Alaska such as Kodiak Island, Prince William Sound, Glacier Bay/Icy Strait, and Cook Inlet (Pitcher and McAllister, 1981; Small *et al.,* 2005; Boveng *et al.,* 2012; Womble, 2012; Womble and Gende, 2013). Harbor seals usually give birth to a single pup between May and mid-July; birthing locations are dispersed over several haulout sites and not confined to major rookeries (Klinkhart *et al.,* 2008).

Harbor seals inhabit the coastal and estuarine waters of Cook Inlet and are observed in both upper and lower Cook Inlet throughout most of the year (Boveng *et al.,* 2012; Shelden *et al.,* 2013). Recent research on satellite-tagged harbor seals observed several movement patterns within Cook Inlet (Boveng *et al.,* 2012), including a strong seasonal pattern of more coastal and restricted spatial use during the spring and summer (breeding, pupping, molting) and more wide-ranging movements within and outside of Cook Inlet during the winter months, with some seals ranging as far as Shumagin Islands. During summer months, movements and distribution were mostly confined to the west side of Cook Inlet and Kachemak Bay, and seals captured in lower Cook Inlet generally exhibited site fidelity by remaining south of the Forelands in lower Cook Inlet after release (Boveng *et al.,* 2012). In the fall, a portion of the harbor seals appeared to move out of Cook Inlet and into Shelikof Strait, northern Kodiak Island, and coastal habitats of the

Alaska Peninsula. The western coast of Cook Inlet had higher usage by harbor seals than eastern coast habitats, and seals captured in lower Cook Inlet generally exhibited site fidelity by remaining south of the Forelands in lower Cook Inlet after release (south of Nikiski; Boveng *et al.,* 2012).

The presence of harbor seals in upper Cook Inlet is seasonal. Harbor seals are commonly observed along the Susitna River and other tributaries within upper Cook Inlet during eulachon and salmon migrations (NMFS, 2003). The major haulout sites for harbor seals are in lower Cook Inlet; however, there are a few haulout sites in upper Cook Inlet, including near the Little and Big Susitna rivers, Beluga River, Theodore River, and Ivan River (Barbara Mahoney, personal communication, November 16, 2020; Montgomery *et al.,* 2007). During CIBW aerial surveys of upper Cook Inlet from 1993 to 2012, harbor seals were observed 24 to 96 km south-southwest of Anchorage at the Chickaloon, Little Susitna, Susitna, Ivan, McArthur, and Beluga rivers (Shelden *et al.,* 2013). Harbor seals have been observed in Knik Arm and in the vicinity of the POA (Shelden *et al.,* 2013), but they are not known to haul out within the proposed project area.

Harbor seals were observed during construction monitoring at the POA from 2005 through 2011 and in 2016 (Prevel-Ramos *et al.,* 2006; Markowitz and McGuire, 2007; Cornick and Saxon-Kendall, 2008, 2009; Cornick *et al.,* 2010, 2011). Harbor seals were observed in groups of one to seven individuals (Cornick *et al.,* 2011; Cornick and Seagars, 2016). Harbor seals were also observed near the POA during construction monitoring for PCT Phase 1 in 2020 and PCT Phase 2 in 2021, NMFS marine mammal monitoring in 2021, and transitional dredging monitoring and SFD construction monitoring in 2022 (61N Environmental, 2021, 2022a, 2022b, 2022c, Easley-Appleyard and Leonard, 2022). During the 2020 PCT Phase 1 and 2021 PCT Phase 2 construction monitoring, harbor seals were regularly observed in the vicinity of the POA with frequent observations near the mouth of Ship Creek, located approximately 2,500 m southeast of the NES1 location. Harbor seals were observed almost daily during 2020 PCT Phase 1 construction, with 54 individuals documented in July, 66 documented in August, and 44 sighted in September (61N Environmental, 2021). During the 2021 PCT Phase 2 construction, harbor seals were observed with the highest numbers of sightings in June (87 individuals) and in September (124 individuals) (61 N Environmental, 2022a). Over the 13 days of SFD construction monitoring in May and June 2022, 27 harbor seals were observed (61N Environmental, 2022b). Seventy-two groups of 75 total harbor seals (3 groups of 2 individuals) were observed during transitional dredging monitoring in 2022 (61N Environmental, 2022c). Sighting rates of harbor seals have been highly variable and may have increased since 2005. It is unknown whether any potential increase was due to local population increases or habituation to ongoing construction activities. It is possible that increased sighting rates are correlated with more intensive monitoring efforts in 2020 and 2021, when the POA used 11 PSOs spread among four monitoring stations.

Marine Mammal Hearing

Hearing is the most important sensory modality for marine mammals underwater, and exposure to anthropogenic sound can have deleterious effects. To appropriately assess the potential effects of exposure to sound, it is necessary to understand the frequency ranges marine mammals are able to hear. Not all marine mammal species have equal hearing capabilities (*e.g.,* Richardson *et al.,* 1995; Wartzok and Ketten, 1999; Au and Hastings, 2008). To reflect this, Southall *et al.* (2007, 2019) recommended that marine mammals be divided into hearing groups based on directly measured (behavioral or auditory evoked potential techniques) or estimated hearing ranges (behavioral response data, anatomical modeling, *etc.*). Note that no direct measurements of hearing ability have been successfully completed for mysticetes (*i.e.,* low-frequency cetaceans). Subsequently, NMFS (2018) described generalized hearing ranges for these marine mammal hearing groups. Generalized hearing ranges were chosen based on the approximately 65-decibel (dB) threshold from the normalized composite audiograms, with the exception for lower limits for low-frequency cetaceans where the lower bound was deemed to be biologically implausible and the lower bound from Southall *et al.* (2007) retained. Marine mammal hearing groups and their associated hearing ranges are provided in Table 5. Specific to this action, gray whales and humpback whales are considered low-frequency (LF) cetaceans, beluga whales and killer whales are considered mid-frequency (MF) cetaceans, harbor porpoises are considered high-frequency (HF) cetaceans, Steller sea lions are otariid pinnipeds, and harbor seals are phocid pinnipeds.

TABLE 5—MARINE MAMMAL HEARING GROUPS

[NMFS, 2018]

Hearing group	Generalized hearing range *
Low-frequency (LF) cetaceans (baleen whales)	7 Hz to 35 kHz.
Mid-frequency (MF) cetaceans (dolphins, toothed whales, beaked whales, bottlenose whales)	150 Hz to 160 kHz.
High-frequency (HF) cetaceans (true porpoises, *Kogia,* river dolphins, Cephalorhynchid, *Lagenorhynchus cruciger* & *L. australis*).	275 Hz to 160 kHz.
Phocid pinnipeds (PW) (underwater) (true seals)	50 Hz to 86 kHz.
Otariid pinnipeds (OW) (underwater) (sea lions and fur seals)	60 Hz to 39 kHz.

* Represents the generalized hearing range for the entire group as a composite (*i.e.,* all species within the group), where individual species' hearing ranges are typically not as broad. Generalized hearing range chosen based on ~65-dB threshold from normalized composite audiogram, with the exception for lower limits for LF cetaceans (Southall *et al.,* 2007) and PW pinniped (approximation).

The pinniped functional hearing group was modified from Southall *et al.* (2007) on the basis of data indicating that phocid species have consistently demonstrated an extended frequency range of hearing compared to otariids, especially in the higher frequency range (Hemilä *et al.,* 2006; Kastelein *et al.,* 2009; Reichmuth and Holt, 2013). This division between phocid and otariid pinnipeds is now reflected in the updated hearing groups proposed in Southall *et al.* (2019).

For more detail concerning these groups and associated frequency ranges, please see NMFS (2018) for a review of available information.

Potential Effects of Specified Activities on Marine Mammals and Their Habitat

This section provides a discussion of the ways in which components of the specified activity may impact marine mammals and their habitat. The Estimated Take of Marine Mammals section later in this document includes a quantitative analysis of the number of individuals that are expected to be taken by this activity. The Negligible Impact Analysis and Determination section considers the content of this section, the Estimated Take section, and the Proposed Mitigation section, to draw conclusions regarding the likely impacts of these activities on the reproductive success or survivorship of individuals and whether those impacts are reasonably expected to, or reasonably likely to, adversely affect the species or stock through effects on annual rates of recruitment or survival.

Acoustic effects on marine mammals during the specified activity are expected to potentially occur from vibratory pile installation and removal, and impact pile removal. The effects of underwater noise from the POA's proposed activities have the potential to result in Level B harassment of marine mammals in the action area and, for some species as a result of certain activities, Level A harassment.

Background on Sound

This section contains a brief technical background on sound, on the characteristics of certain sound types, and on metrics used relevant to the specified activity and to a discussion of the potential effects of the specified activity on marine mammals found later in this document. For general information on sound and its interaction with the marine environment, please see: Erbe and Thomas (2022); Au and Hastings (2008); Richardson *et al.* (1995); Urick (1983); as well as the Discovery of Sound in the Sea website at *https://dosits.org/.*

Sound is a vibration that travels as an acoustic wave through a medium such as a gas, liquid or solid. Sound waves alternately compress and decompress the medium as the wave travels. In water, sound waves radiate in a manner similar to ripples on the surface of a pond and may be either directed in a beam (narrow beam or directional sources) or sound may radiate in all directions (omnidirectional sources), as is the case for sound produced by the construction activities considered here. The compressions and decompressions associated with sound waves are detected as changes in pressure by marine mammals and human-made sound receptors such as hydrophones.

Sound travels more efficiently in water than almost any other form of energy, making the use of sound as a primary sensory modality ideal for inhabitants of the aquatic environment. In seawater, sound travels at roughly 1,500 meters per second (m/s). In air, sound waves travel much more slowly at about 340 m/s. However, the speed of sound in water can vary by a small amount based on characteristics of the transmission medium such as temperature and salinity.

The basic characteristics of a sound wave are frequency, wavelength, velocity, and amplitude. Frequency is the number of pressure waves that pass by a reference point per unit of time and is measured in hertz (Hz) or cycles per second. Wavelength is the distance between two peaks or corresponding points of a sound wave (length of one cycle). Higher frequency sounds have shorter wavelengths than lower frequency sounds, and typically attenuate (decrease) more rapidly with distance, except in certain cases in shallower water. The amplitude of a sound pressure wave is related to the subjective ''loudness'' of a sound and is typically expressed in decibels (dB), which are a relative unit of measurement that is used to express the ratio of one value of a power or pressure to another. A sound pressure level (SPL) in dB is described as the ratio between a measured pressure and a reference pressure, and is a logarithmic unit that accounts for large variations in amplitude; therefore, a relatively small change in dB corresponds to large changes in sound pressure. For example, a 10-dB increase is a ten-fold increase in acoustic power. A 20-dB increase is then a 100-fold increase in power and a 30-dB increase is a 1000-fold increase in power. However, a ten-fold increase in acoustic power does not mean that the sound is perceived as being 10 times louder. The dB is a relative unit comparing two pressures; therefore, a reference pressure must always be indicated. For underwater sound, this is 1 microPascal (μPa). For in-air sound, the reference pressure is 20 microPascal (μPa). The amplitude of a sound can be presented in various ways; however, NMFS typically considers three metrics: sound exposure level (SEL), root-mean-square (RMS) SPL, and peak SPL (defined below). The source level represents the SPL referenced at a standard distance from the source, typically 1 m (Richardson *et al.,* 1995; American National Standards Institute (ANSI, 2013), while the received level is the SPL at the receiver's position. For pile driving activities, the SPL is typically referenced at 10 m.

SEL (represented as dB referenced to 1 micropascal squared second (re 1 μPa^2-s)) represents the total energy in a stated frequency band over a stated time interval or event, and considers both intensity and duration of exposure. The per-pulse SEL (*e.g.,* single strike or single shot SEL) is calculated over the time window containing the entire pulse (*i.e.,* 100 percent of the acoustic energy). SEL can also be a cumulative metric; it can be accumulated over a single pulse (for pile driving this is the same as single-strike SEL, above; SEL_{ss}), or calculated over periods containing multiple pulses (SEL_{cum}). Cumulative SEL (SEL_{cum}) represents the total energy accumulated by a receiver over a defined time window or during an event. The SEL metric is useful because it allows sound exposures of different durations to be related to one another in terms of total acoustic energy. The duration of a sound event and the number of pulses, however, should be specified as there is no accepted standard duration over which the summation of energy is measured.

RMS SPL is equal to 10 times the logarithm (base 10) of the ratio of the mean-square sound pressure to the specified reference value, and given in units of dB (International Organization for Standardization (ISO), 2017). RMS is calculated by squaring all of the sound amplitudes, averaging the squares, and then taking the square root of the average (Urick, 1983). RMS accounts for both positive and negative values; squaring the pressures makes all values positive so that they may be accounted for in the summation of pressure levels (Hastings and Popper, 2005). This measurement is often used in the context of discussing behavioral effects, in part because behavioral effects, which often result from auditory cues, may be better expressed through averaged units than by peak SPL. For impulsive sounds, RMS is calculated by the portion of the waveform containing 90 percent of the sound energy from the impulsive event (Madsen, 2005).

Peak SPL (also referred to as zero-to-peak sound pressure or 0-pk) is the maximum instantaneous sound pressure measurable in the water, which can arise from a positive or negative sound pressure, during a specified time, for a specific frequency range at a specified distance from the source, and is represented in the same units as the RMS sound pressure (ISO, 2017). Along with SEL, this metric is used in evaluating the potential for permanent threshold shift (PTS) and temporary threshold shift (TTS) associated with impulsive sound sources.

Sounds are also characterized by their temporal components. Continuous sounds are those whose sound pressure level remains above that of the ambient or background sound with negligibly small fluctuations in level (ANSI, 2005) while intermittent sounds are defined as sounds with interrupted levels of low or no sound (National Institute for Occupational Safety and Health (NIOSH), 1998). A key distinction between continuous and intermittent sound sources is that intermittent sounds have a more regular (predictable) pattern of bursts of sounds and silent periods (*i.e.,* duty cycle), which continuous sounds do not.

Sounds may be either impulsive or non-impulsive (defined below). The distinction between these two sound types is important because they have differing potential to cause physical effects, particularly with regard to noise-induced hearing loss (*e.g.,* Ward, 1997 in Southall *et al.,* 2007). Please see NMFS (2018) and Southall *et al.* (2007, 2019) for an in-depth discussion of these concepts.

Impulsive sound sources (*e.g.,* explosions, gunshots, sonic booms, seismic airgun shots, impact pile driving) produce signals that are brief (typically considered to be less than 1 second), broadband, atonal transients (ANSI, 1986, 2005; NIOSH, 1998) and occur either as isolated events or repeated in some succession. Impulsive sounds are all characterized by a relatively rapid rise from ambient pressure to a maximal pressure value followed by a rapid decay period that may include a period of diminishing, oscillating maximal and minimal pressures, and generally have an increased capacity to induce physical injury as compared with sounds that lack these features. Impulsive sounds are intermittent in nature. The duration of such sounds, as received at a distance, can be greatly extended in a highly reverberant environment.

Non-impulsive sounds can be tonal, narrowband, or broadband, brief or prolonged, and may be either continuous or non-continuous (ANSI, 1995; NIOSH, 1998). Some of these non-impulsive sounds can be transient signals of short duration but without the essential properties of impulses (*e.g.,* rapid rise time). Examples of non-impulsive sounds include those produced by vessels, aircraft, machinery operations such as drilling or dredging, vibratory pile driving, and active sonar systems.

Even in the absence of sound from the specified activity, the underwater environment is characterized by sounds from both natural and anthropogenic sound sources. Ambient sound is defined as a composite of naturally-occurring (*i.e.,* non-anthropogenic) sound from many sources both near and far (ANSI, 1995). Background sound is similar, but includes all sounds, including anthropogenic sounds, minus the sound produced by the proposed activities (NMFS, 2012, 2016a). The sound level of a region is defined by the total acoustical energy being generated by known and unknown sources. These sources may include physical (*e.g.,* wind and waves, earthquakes, ice, atmospheric sound), biological (*e.g.,* sounds produced by marine mammals, fish, and invertebrates), and anthropogenic (*e.g.,* vessels, dredging, construction) sound. A number of sources contribute to background and ambient sound, including wind and waves, which are a main source of naturally occurring ambient sound for frequencies between 200 Hz and 50 kilohertz (kHz) (Mitson, 1995). In general, background and ambient sound levels tend to increase with increasing wind speed and wave height. Precipitation can become an important component of total sound at frequencies above 500 Hz, and possibly down to 100 Hz during quiet times. Marine mammals can contribute significantly to background and ambient sound levels, as can some fish and snapping shrimp. The frequency band for biological contributions is from approximately 12 Hz to over 100 kHz. Sources of background sound related to human activity include transportation (surface vessels), dredging and construction, oil and gas drilling and production, geophysical surveys, sonar, and explosions. Vessel noise typically dominates the total background sound for frequencies between 20 and 300 Hz. In general, the frequencies of many anthropogenic sounds, particularly those produced by construction activities, are below 1 kHz (Richardson *et al.,* 1995). When sounds at frequencies greater than 1 kHz are produced, they generally attenuate relatively rapidly (Richardson *et al.,* 1995), particularly above 20 kHz due to propagation losses and absorption (Urick, 1983).

Transmission loss (*TL*) defines the degree to which underwater sound has spread in space and lost energy after having moved through the environment and reached a receiver. It is defined by the ISO as the reduction in a specified level between two specified points that are within an underwater acoustic field (ISO, 2017). Careful consideration of transmission loss and appropriate propagation modeling is a crucial step in determining the impacts of underwater sound, as it helps to define the ranges (isopleths) to which impacts are expected and depends significantly on local environmental parameters such as seabed type, water depth (bathymetry), and the local speed of sound. Geometric spreading laws are powerful tools which provide a simple means of estimating *TL,* based on the shape of the sound wave front in the water column. For a sound source that is equally loud in all directions and in deep water, the sound field takes the form of a sphere, as the sound extends in every direction uniformly. In this case, the intensity of the sound is spread across the surface of the sphere, and thus we can relate intensity loss to the square of the range (as area = $4*pi*r^2$). When expressing logarithmically in dB as *TL,* we find that $TL = 20*Log_{10}(range)$, this situation is known as spherical spreading. In shallow water, the sea surface and seafloor will bound the shape of the sound, leading to a more cylindrical shape, as the top and bottom of the sphere is truncated by the largely reflective boundaries. This situation is termed cylindrical spreading, and is given by $TL = 10*Log_{10}(range)$ (Urick, 1983). An intermediate scenario may be defined by the equation $TL = 15*Log_{10}(range)$, and is referred to as practical spreading. Though these geometric spreading laws do not capture many often important details (scattering, absorption, *etc.*), they offer a reasonable and simple approximation of how sound decreases in intensity as it is transmitted. In the absence of measured data indicating the level of transmission loss at a given site for a specific activity, NMFS recommends practical spreading (*i.e.,* $15*Log_{10}(range)$) to model acoustic propagation for construction activities in most nearshore environments.

The sum of the various natural and anthropogenic sound sources at any given location and time depends not only on the source levels, but also on the propagation of sound through the environment. Sound propagation is dependent on the spatially and temporally varying properties of the water column and sea floor, and is frequency-dependent. As a result of the dependence on a large number of varying factors, background and ambient sound levels can be expected to vary widely over both coarse and fine spatial and temporal scales. Sound levels at a given frequency and location can vary by 10 to 20 dB from day to day (Richardson *et al.,* 1995). The result is that, depending on the source type and its intensity, sound from the specified activity may be a negligible addition to the local environment or could form a distinctive signal that may affect marine mammals.

Background underwater noise levels in the NES1 Project area are both variable and relatively high, primarily because of extreme tidal activity, elevated sediment loads in the water column, periodic high winds, the seasonal presence of ice, and anthropogenic activities. Sources of anthropogenic noise in the NES1 Project area consist of dredging operations, boats, ships, oil and gas operations, construction noise, and aircraft overflights from JBER and Ted Stevens International Airport, all of which contribute to high underwater noise levels in upper Cook Inlet (*e.g.,* Blackwell and Greene, 2002; (Knik Arm Bridge and Toll Authority (KABATA), 2011). The lower range of broadband (10 to 10,000 Hz) background sound levels obtained during underwater measurements at Port MacKenzie, located across Knik Arm from the POA, ranged from 115 to 133 dB re 1 μPa RMS (Blackwell, 2005). Background sound levels measured during the 2007 test pile study for the POA's Marine Terminal Redevelopment Project (MTRP) site ranged from 105 to 135 dB (URS Corporation, 2007). The background SPLs obtained in that study were highly variable, with most SPL recordings exceeding 120 dB RMS. Background sound levels measured in 2008 at the MTRP site ranged from 120 to 150 dB RMS (Scientific Fishery Systems, Inc., 2009). These measurements included industrial sounds from maritime operations, but ongoing USACE maintenance dredging and pile driving from construction were not underway at the time of the study.

Background sound levels were measured at the POA during the PAMP 2016 Test Pile Program (TPP) in the absence of pile driving at two locations during a 3-day break in pile installation. Median background noise levels, measured at a location just offshore of the POA SFD and at a second location about 1 km offshore, were 117 and 122.2 dB RMS, respectively (Austin *et al.,* 2016). NMFS considers the median sound levels to be most appropriate when considering background noise levels for purposes of evaluating the potential impacts of the proposed project on marine mammals (NMFS, 2012). By using the median value, which is the 50th percentile of the measurements, for background noise levels, one will be able to eliminate the few transient loud identifiable events that do not represent the true ambient condition of the area. This is relevant because during 2 of the 4 days (50 percent) when background measurement data were being collected, the USACE was dredging Terminal 3 (located just north of the Ambient-Offshore hydrophone) for 24 hours per day with two 1-hour breaks for crew change. On the last 2 days of data collection, no dredging was occurring. Therefore, the median provides a better representation of background noise levels when the NES1 project would be occurring. During the measurements, some typical sound signals were noted, such as noise from current flow and the passage of vessels.

With regard to spatial considerations of the measurements, the offshore location is most applicable to assessing background sound during the NES1 Project (NMFS, 2012). The median background noise level measured at the offshore hydrophone was 122.2 dB RMS. The measurement location closer to the POA was quieter, with a median of 117 dB; however, that hydrophone was placed very close to a dock. During PCT acoustic monitoring, noise levels in Knik Arm absent pile driving were also collected (Illingworth & Rodkin (I&R), 2021a, 2022b)); however, the PCT IHAs did not require background noise measurements to be collected. These measurements were not collected in accordance to NMFS (2012) guidance for measuring background noise and thus cannot be used here for that purpose. Despite this, the noise levels measured during the PCT project were not significantly different from 122.2 dB (I&R, 2021a, 2022b). If additional background data are collected in the future in this region, NMFS may re-evaluate the data to appropriately characterize background sound levels in Knik Arm.

Description of Sound Sources for the Specified Activities

In-water construction activities associated with the project that have the potential to incidentally take marine mammals through exposure to sound would include impact sheet pile removal, vibratory pile installation and removal, and pile splitting (assumed to be similar to vibratory pile installation and removal). Impact hammers typically operate by repeatedly dropping and/or pushing a heavy piston onto a pile to drive the pile into the substrate. For the NES1 project, a small number of strikes from an impact hammer may be used to loosen sheet piles for removal. Sound generated by impact hammers is impulsive, characterized by rapid rise times and high peak levels, a potentially injurious combination (Hastings and Popper, 2005). Vibratory hammers install piles by vibrating them and allowing the weight of the hammer to push them into the sediment. Vibratory hammers typically produce less sound (*i.e.,* lower levels) than impact hammers. Peak SPLs may be 180 dB or greater, but are generally 10 to 20 dB lower than SPLs generated during impact pile driving of the same-sized pile (Oestman *et al.,* 2009; California Department of Transportation (CALTRANS), 2015, 2020). Sounds produced by vibratory hammers are non-impulsive; the rise time is slower, reducing the probability and severity of injury, and the sound energy is distributed over a greater amount of time (Nedwell and Edwards, 2002; Carlson *et al.,* 2005).

The likely or possible impacts of the POA's proposed activities on marine mammals could involve both non-acoustic and acoustic stressors. Potential non-acoustic stressors could result from the physical presence of the equipment and personnel; however, given there are no known pinniped haul-out sites in the vicinity of the NES1 project site, visual and other non-acoustic stressors would be limited, and any impacts to marine mammals are expected to primarily be acoustic in nature.

Acoustic Impacts

The introduction of anthropogenic noise into the aquatic environment from pile driving is the primary means by which marine mammals may be harassed from the POA's specified activity. In general, animals exposed to natural or anthropogenic sound may experience physical and psychological effects, ranging in magnitude from none to severe (Southall *et al.,* 2007, 2019). Exposure to pile driving noise has the potential to result in auditory threshold shifts and behavioral reactions (*e.g.,* avoidance, temporary cessation of foraging and vocalizing, changes in dive behavior). Exposure to anthropogenic noise can also lead to non-observable physiological responses, such as an increase in stress hormones. Additional noise in a marine mammal's habitat can mask acoustic cues used by marine mammals to carry out daily functions, such as communication and predator and prey detection. The effects of pile driving noise on marine mammals are dependent on several factors, including, but not limited to, sound type (*e.g.,* impulsive vs. non-impulsive), the species, age and sex class (*e.g.,* adult male vs. mom with calf), duration of exposure, the distance between the pile and the animal, received levels, behavior at time of exposure, and previous history with exposure (Wartzok *et al.,* 2004; Southall *et al.,* 2007). Here we discuss physical auditory effects (threshold shifts) followed by behavioral effects and potential impacts on habitat.

NMFS defines a noise-induced threshold shift (TS) as a change, usually an increase, in the threshold of audibility at a specified frequency or portion of an individual's hearing range above a previously established reference level (NMFS, 2018). The amount of threshold shift is customarily expressed in dB. A TS can be permanent or temporary. As described in NMFS (2018) there are numerous factors to consider when examining the consequence of TS, including, but not limited to, the signal temporal pattern (*e.g.,* impulsive or non-impulsive), likelihood an individual would be exposed for a long enough duration or to a high enough level to induce a TS, the magnitude of the TS, time to recovery (seconds to minutes or hours to days), the frequency range of the exposure (*i.e.,* spectral content), the hearing frequency range of the exposed species relative to the signal's frequency spectrum (*i.e.,* how animal uses sound within the frequency band of the signal; *e.g.,* Kastelein *et al.,* 2014), and the overlap between the animal and the source (*e.g.,* spatial, temporal, and spectral).

Permanent Threshold Shift (PTS). NMFS defines PTS as a permanent, irreversible increase in the threshold of audibility at a specified frequency or portion of an individual's hearing range above a previously established reference level (NMFS, 2018). PTS does not generally affect more than a limited frequency range, and an animal that has incurred PTS has incurred some level of hearing loss at the relevant frequencies; typically animals with PTS are not functionally deaf (Au and Hastings, 2008; Finneran, 2016). Available data from humans and other terrestrial mammals indicate that a 40-dB threshold shift approximates PTS onset (see Ward *et al.,* 1958, 1959, 1960; Kryter *et al.,* 1966; Miller, 1974; Ahroon *et al.,* 1996; Henderson *et al.,* 2008). PTS levels for marine mammals are estimates, as with the exception of a single study unintentionally inducing PTS in a harbor seal (Kastak *et al.,* 2008), there are no empirical data measuring PTS in marine mammals largely due to the fact that, for various ethical reasons, experiments involving anthropogenic noise exposure at levels inducing PTS are not typically pursued or authorized (NMFS, 2018).

Temporary Threshold Shift (TTS). A temporary, reversible increase in the threshold of audibility at a specified frequency or portion of an individual's hearing range above a previously established reference level (NMFS, 2018). Based on data from marine mammal TTS measurements (see Southall *et al.,* 2007, 2019), a TTS of 6 dB is considered the minimum threshold shift clearly larger than any day-to-day or session-to-session variation in a subject's normal hearing ability (Finneran *et al.,* 2000, 2002; Schlundt *et al.,* 2000). As described in Finneran (2015), marine mammal studies have shown the amount of TTS increases with SEL_{cum} in an accelerating fashion: at low exposures with lower SEL_{cum}, the amount of TTS is typically small and the growth curves have shallow slopes. At exposures with higher SEL_{cum}, the growth curves become steeper and approach linear relationships with the noise SEL.

Depending on the degree (elevation of threshold in dB), duration (*i.e.,* recovery time), and frequency range of TTS, and the context in which it is experienced, TTS can have effects on marine mammals ranging from discountable to serious (similar to those discussed in auditory masking, below). For example, a marine mammal may be able to readily compensate for a brief, relatively small amount of TTS in a non-critical frequency range that takes place during a time when the animal is traveling through the open ocean, where ambient noise is lower and there are not as many competing sounds present. Alternatively, a larger amount and longer duration of TTS sustained during time when communication is critical for successful mother/calf interactions could have more serious impacts. We note that reduced hearing sensitivity as a simple function of aging has been observed in marine mammals, as well as humans and other taxa (Southall *et al.,* 2007), so we can infer that strategies exist for coping with this condition to some degree, though likely not without cost.

Many studies have examined noise-induced hearing loss in marine mammals (see Finneran (2015) and Southall *et al.* (2019) for summaries). TTS is the mildest form of hearing impairment that can occur during exposure to sound (Kryter, 2013). While experiencing TTS, the hearing threshold rises, and a sound must be at a higher level in order to be heard. In terrestrial and marine mammals, TTS can last from minutes or hours to days (in cases of strong TTS). In many cases, hearing sensitivity recovers rapidly after exposure to the sound ends. For cetaceans, published data on the onset of TTS are limited to captive bottlenose dolphin (*Tursiops truncatus*), beluga whale, harbor porpoise, and Yangtze finless porpoise (*Neophocoena asiaeorientalis*) (Southall *et al.,* 2019). For pinnipeds in water, measurements of TTS are limited to harbor seals, elephant seals (*Mirounga angustirostris*), bearded seals (*Erignathus barbatus*) and California sea lions (*Zalophus californianus*) (Kastak *et al.,* 1999, 2007; Kastelein *et al.,* 2019b, 2019c, 2021, 2022a, 2022b; Reichmuth *et al.,* 2019; Sills *et al.,* 2020). TTS was not observed in spotted (*Phoca largha*) and ringed (*Pusa hispida*) seals exposed to single airgun impulse sounds at levels matching previous predictions of TTS onset (Reichmuth *et al.,* 2016). These studies examine hearing thresholds measured in marine mammals before and after exposure to intense or long-duration sound exposures. The difference between the pre-exposure and post-exposure thresholds can be used to determine the amount of threshold shift at various post-exposure times.

The amount and onset of TTS depends on the exposure frequency. Sounds at low frequencies, well below the region of best sensitivity for a species or hearing group, are less hazardous than those at higher frequencies, near the region of best sensitivity (Finneran and Schlundt, 2013). At low frequencies, onset-TTS exposure levels are higher compared to those in the region of best sensitivity (*i.e.,* a low frequency noise would need to be louder to cause TTS onset when TTS exposure level is higher), as shown for harbor porpoises and harbor seals (Kastelein *et al.,* 2019a, 2019c). Note that in general, harbor seals and harbor porpoises have a lower TTS onset than other measured pinniped or cetacean species (Finneran, 2015). In addition, TTS can accumulate across multiple exposures, but the resulting TTS will be less than the TTS from a single, continuous exposure with the same SEL (Mooney *et al.,* 2009; Finneran *et al.,* 2010; Kastelein *et al.,* 2014, 2015). This means that TTS predictions based on the total, cumulative SEL will overestimate the amount of TTS from intermittent exposures, such as sonars and impulsive sources. Nachtigall *et al.* (2018) describe measurements of hearing sensitivity of multiple odontocete species (bottlenose dolphin, harbor porpoise, beluga, and false killer whale (*Pseudorca crassidens*)) when a relatively loud sound was preceded by a warning sound. These captive animals were shown to reduce hearing sensitivity when warned of an impending intense sound. Based on these experimental observations of captive animals, the authors suggest that wild animals may dampen their hearing during prolonged exposures or if conditioned to anticipate intense sounds. Another study showed that echolocating animals (including odontocetes) might have anatomical specializations that might allow for conditioned hearing reduction and filtering of low-frequency ambient noise, including increased stiffness and control of middle ear structures and placement of inner ear structures (Ketten *et al.,* 2021). Data available on noise-induced hearing loss for mysticetes are currently lacking (NMFS, 2018). Additionally, the existing marine mammal TTS data come from a limited number of individuals within these species.

Relationships between TTS and PTS thresholds have not been studied in marine mammals, and there is no PTS data for cetaceans, but such relationships are assumed to be similar to those in humans and other terrestrial mammals. PTS typically occurs at exposure levels at least several decibels above that inducing mild TTS (*e.g.,* a 40-dB threshold shift approximates PTS onset (Kryter *et al.,* 1966; Miller, 1974), while a 6-dB threshold shift approximates TTS onset (Southall *et al.,* 2007, 2019). Based on data from terrestrial mammals, a precautionary assumption is that the PTS thresholds for impulsive sounds (such as impact pile driving pulses as received close to the source) are at least 6 dB higher than the TTS threshold on a peak-pressure basis and PTS cumulative sound exposure level thresholds are 15 to 20 dB higher than TTS cumulative sound exposure level thresholds (Southall *et al.,* 2007, 2019). Given the higher level of sound or longer exposure duration necessary to cause PTS as compared with TTS, it is considerably less likely that PTS could occur.

Behavioral Harassment. Exposure to noise also has the potential to behaviorally disturb marine mammals to a level that rises to the definition of harassment under the MMPA. Generally speaking, NMFS considers a behavioral disturbance that rises to the level of harassment under the MMPA a non-minor response—in other words, not every response qualifies as behavioral disturbance, and for responses that do, those of a higher level, or accrued across a longer duration, have the potential to affect foraging, reproduction, or survival. Behavioral disturbance may include a variety of effects, including subtle changes in behavior (*e.g.,* minor or brief avoidance of an area or changes in vocalizations), more conspicuous changes in similar behavioral activities, and more sustained and/or potentially severe reactions, such as displacement from or abandonment of high-quality habitat. Behavioral responses may include changing durations of surfacing and dives, changing direction and/or speed; reducing/increasing vocal activities; changing/cessation of certain behavioral activities (such as socializing or feeding); eliciting a visible startle response or aggressive behavior (such as tail/fin slapping or jaw clapping); avoidance of areas where sound sources are located. Pinnipeds may increase their haul out time, possibly to avoid in-water disturbance (Thorson and Reyff, 2006). Behavioral responses to sound are highly variable and context-specific and any reactions depend on numerous intrinsic and extrinsic factors (*e.g.,* species, state of maturity, experience, current activity, reproductive state, auditory sensitivity, time of day), as well as the interplay between factors (*e.g.,* Richardson *et al.,* 1995; Wartzok *et al.,* 2004; Southall *et al.,* 2007, 2019; Weilgart, 2007; Archer *et al.,* 2010). Behavioral reactions can vary not only among individuals but also within an individual, depending on previous experience with a sound source, context, and numerous other factors (Ellison *et al.,* 2012), and can vary depending on characteristics associated with the sound source (*e.g.,* whether it is moving or stationary, number of sources, distance from the source). In general, pinnipeds seem more tolerant of, or at least habituate more quickly to, potentially disturbing underwater sound than do cetaceans, and generally seem to be less responsive to exposure to industrial sound than most cetaceans. Please see Appendices B and C of Southall *et al.* (2007) and Gomez *et al.* (2016) for reviews of studies involving marine mammal behavioral responses to sound.

Habituation can occur when an animal's response to a stimulus wanes with repeated exposure, usually in the absence of unpleasant associated events (Wartzok *et al.,* 2004). Animals are most likely to habituate to sounds that are predictable and unvarying. It is important to note that habituation is appropriately considered as a ''progressive reduction in response to stimuli that are perceived as neither aversive nor beneficial,'' rather than as, more generally, moderation in response to human disturbance (Bejder *et al.,* 2009). The opposite process is sensitization, when an unpleasant experience leads to subsequent responses, often in the form of avoidance, at a lower level of exposure.

As noted above, behavioral state may affect the type of response. For example, animals that are resting may show greater behavioral change in response to disturbing sound levels than animals that are highly motivated to remain in an area for feeding (Richardson *et al.,* 1995; Wartzok *et al.,* 2004; National Research Council (NRC), 2005). Controlled experiments with captive marine mammals have showed pronounced behavioral reactions, including avoidance of loud sound sources (Ridgway *et al.,* 1997; Finneran *et al.,* 2003). Observed responses of wild marine mammals to loud pulsed sound sources (*e.g.,* seismic airguns) have been varied but often consist of avoidance behavior or other behavioral changes (Richardson *et al.,* 1995; Morton and Symonds, 2002; Nowacek *et al.,* 2007).

Available studies show wide variation in response to underwater sound; therefore, it is difficult to predict specifically how any given sound in a particular instance might affect marine mammals perceiving the signal. If a marine mammal does react briefly to an underwater sound by changing its behavior or moving a small distance, the impacts of the change are unlikely to be significant to the individual, let alone the stock or population. However, if a sound source displaces marine mammals from an important feeding or breeding area for a prolonged period, impacts on individuals and populations could be significant (*e.g.,* Lusseau and Bejder, 2007; Weilgart, 2007; NRC, 2005). However, there are broad categories of potential response, which we describe in greater detail here, that include alteration of dive behavior, alteration of foraging behavior, effects to breathing, interference with or alteration of vocalization, avoidance, and flight.

Changes in dive behavior can vary widely and may consist of increased or decreased dive times and surface intervals as well as changes in the rates of ascent and descent during a dive (*e.g.,* Frankel and Clark, 2000; Costa *et al.,* 2003; Ng and Leung, 2003; Nowacek *et al.,* 2004; Goldbogen *et al.,* 2013a, 2013b). Variations in dive behavior may reflect interruptions in biologically significant activities (*e.g.,* foraging) or they may be of little biological significance. The impact of an alteration to dive behavior resulting from an acoustic exposure depends on what the animal is doing at the time of the exposure and the type and magnitude of the response.

Disruption of feeding behavior can be difficult to correlate with anthropogenic sound exposure, so it is usually inferred by observed displacement from known foraging areas, the appearance of secondary indicators (*e.g.,* bubble nets or sediment plumes), or changes in dive behavior. As for other types of behavioral response, the frequency, duration, and temporal pattern of signal presentation, as well as differences in species sensitivity, are likely contributing factors to differences in response in any given circumstance (*e.g.,* Croll *et al.,* 2001; Nowacek *et al.,* 2004; Madsen *et al.,* 2006; Yazvenko *et al.,* 2007). A determination of whether foraging disruptions incur fitness consequences would require information on or estimates of the energetic requirements of the affected individuals and the relationship between prey availability, foraging effort and success, and the life history stage of the animal.

Variations in respiration naturally vary with different behaviors and alterations to breathing rate as a function of acoustic exposure can be expected to co-occur with other behavioral reactions, such as a flight response or an alteration in diving. However, respiration rates in and of themselves may be representative of annoyance or an acute stress response. Various studies have shown that respiration rates may either be unaffected or could increase, depending on the species and signal characteristics, again highlighting the importance in understanding species differences in the tolerance of underwater noise when determining the potential for impacts resulting from anthropogenic sound exposure (*e.g.,* Kastelein *et al.,* 2001, 2005, 2006; Gailey *et al.,* 2007). For example, harbor porpoise' respiration rate increased in response to pile driving sounds at and above a received broadband SPL of 136 dB (zero-peak SPL: 151 dB re 1 µPa; SEL of a single strike: 127 dB re 1 µPa^2-s) (Kastelein *et al.,* 2013).

Marine mammals vocalize for different purposes and across multiple modes, such as whistling, echolocation click production, calling, and singing. Changes in vocalization behavior in response to anthropogenic noise can occur for any of these modes and may result from a need to compete with an increase in background noise or may reflect increased vigilance or a startle response. For example, in the presence of potentially masking signals, humpback whales and killer whales have been observed to increase the length of their songs (Miller *et al.,* 2000; Fristrup *et al.,* 2003) or vocalizations (Foote *et al.,* 2004), respectively, while North Atlantic right whales (*Eubalaena glacialis*) have been observed to shift the frequency content of their calls upward while reducing the rate of calling in areas of increased anthropogenic noise (Parks *et al.,* 2007). In some cases, animals may cease sound production during production of aversive signals (Bowles *et al.,* 1994).

Avoidance is the displacement of an individual from an area or migration path as a result of the presence of a sound or other stressors, and is one of the most obvious manifestations of disturbance in marine mammals (Richardson *et al.,* 1995). For example, gray whales are known to change direction—deflecting from customary migratory paths—in order to avoid noise from seismic surveys (Malme *et al.,* 1984). Avoidance may be short-term, with animals returning to the area once the noise has ceased (*e.g.,* Bowles *et al.,* 1994; Goold, 1996; Stone *et al.,* 2000; Morton and Symonds, 2002; Gailey *et al.,* 2007). Longer-term displacement is possible, however, which may lead to changes in abundance or distribution patterns of the affected species in the affected region if habituation to the presence of the sound does not occur (*e.g.,* Blackwell *et al.,* 2004; Bejder *et al.,* 2006; Teilmann *et al.,* 2006).

A flight response is a dramatic change in normal movement to a directed and rapid movement away from the perceived location of a sound source. The flight response differs from other avoidance responses in the intensity of the response (*e.g.,* directed movement, rate of travel). Relatively little information on flight responses of marine mammals to anthropogenic signals exist, although observations of flight responses to the presence of predators have occurred (Connor and Heithaus, 1996; Bowers *et al.,* 2018). The result of a flight response could range from brief, temporary exertion and displacement from the area where the signal provokes flight to, in extreme cases, marine mammal strandings (England *et al.,* 2001). However, it should be noted that response to a perceived predator does not necessarily invoke flight (Ford and Reeves, 2008), and whether individuals are solitary or in groups may influence the response.

Behavioral disturbance can also impact marine mammals in more subtle ways. Increased vigilance may result in costs related to diversion of focus and attention (*i.e.,* when a response consists of increased vigilance, it may come at the cost of decreased attention to other critical behaviors such as foraging or resting). These effects have generally not been demonstrated for marine mammals, but studies involving fishes and terrestrial animals have shown that increased vigilance may substantially reduce feeding rates (*e.g.,* Beauchamp and Livoreil, 1997; Fritz *et al.,* 2002; Purser and Radford, 2011). In addition, chronic disturbance can cause population declines through reduction of fitness (*e.g.,* decline in body condition) and subsequent reduction in reproductive success, survival, or both (*e.g.,* Harrington and Veitch, 1992; Daan *et al.,* 1996; Bradshaw *et al.,* 1998). However, Ridgway *et al.* (2006) reported that increased vigilance in bottlenose dolphins exposed to sound over a 5-day period did not cause any sleep deprivation or stress effects.

Many animals perform vital functions, such as feeding, resting, traveling, and socializing, on a diel cycle (24-hour cycle). Disruption of such functions resulting from reactions to stressors such as sound exposure are more likely to be significant if they last more than one diel cycle or recur on subsequent days (Southall *et al.,* 2007). Consequently, a behavioral response lasting less than 1 day and not recurring on subsequent days is not considered particularly severe unless it could directly affect reproduction or survival (Southall *et al.,* 2007). Note that there is a difference between multi-day substantive (*i.e.,* meaningful) behavioral reactions and multi-day anthropogenic activities. For example, just because an activity lasts for multiple days does not necessarily mean that individual animals are either exposed to activity-related stressors for multiple days or, further, exposed in a manner resulting in sustained multi-day substantive behavioral responses.

Behavioral Reactions Observed at the POA. Specific to recent construction at the POA, behavioral reactions to pile driving have not been reported in non-CIBW species. During POA's PCT construction, 81 harbor seals were observed within estimated Level B harassment zones associated with vibratory and impact installation and or removal of 36-inch (61-cm) and 144-inch (366-cm) piles, and five harbor seals were observed within estimated Level A harassment zones during the installation of 144-inch (366-cm) piles. No observable behavioral reactions were observed in any of these seals (61N Environmental, 2021, 2022a). One harbor porpoise was observed within the estimated Level B harassment zone during vibratory driving of a 36-inch (61-cm) pile in May 2021. The animal was travelling at a moderate pace. No observable reactions to pile driving were noted by the PSOs. Another harbor porpoise may have been within the estimated Level B harassment zone during the impact installation of 36-inch (61-cm) piles in June 2021, but PSOs did not record any behavioral responses of this individual to the pile driving activities. Similarly 13 harbor seals observed within estimated Level B harassment zones associated with pile driving 36-inch (61-cm) piles during POA's SFD construction did not exhibit observable behavioral reactions (61N Environmental, 2022b).

Specific to CIBWs, several years of marine mammal monitoring data demonstrate the behavioral responses to pile driving at the POA. Previous pile driving activities at the POA include the installation and removal of sheet piles, the vibratory and impact installation of 24-inch (61-cm), 36-inch (91-cm), 48-in (122-cm), and 144-inch (366-cm) pipe piles, and the vibratory installation of 72-inch (183-cm) air bubble casings.

Kendall and Cornick (2015) provide a comprehensive overview of 4 years of scientific marine mammal monitoring conducted before (2005–2006) and during the POA's MTR Project P (2008–2009). These were observations made by PSOs independent of the POA and their pile driving activities (*i.e.,* not construction based PSOs). The authors investigated CIBW behavior before and during pile driving activity at the POA. Sighting rates, mean sighting duration, behavior, mean group size, group composition, and group formation were compared between the two periods. A total of about 2,329 hours of sampling effort was completed across 349 days from 2005 to 2009. Overall, 687 whales in 177 groups were documented during the 69 days that whales were sighted. A total of 353 and 1,663 hours of pile driving took place in 2008 and 2009, respectively. There was no relationship between monthly CIBW sighting rates and monthly pile driving rates ($r = 0.19$, $p = 0.37$). Sighting rates before (n = 12; 0.06 ± 0.01) and during (n = 13; 0.01 ± 0.03) pile driving were not significantly different. However, sighting duration of CIBWs decreased significantly during pile driving (39 ± 6 min before and 18 ± 3 min during). There were also significant differences in behavior before versus during pile driving. CIBWs primarily traveled through the study area both before and during pile driving; however, traveling increased relative to other behaviors during pile driving. Documentation of milling was observed on 21 occasions during pile driving. Mean group size decreased during pile driving; however, this difference was not statistically significant. In addition, group composition was significantly different before and during pile driving, with more white (*i.e.,* likely older) animals being present during pile driving (Kendall and Cornick, 2015). CIBWs were primarily observed densely packed before and during pile driving; however, the number of densely packed groups increased by approximately 67 percent during pile driving. There were also significant increases in the number of dispersed groups (approximately 81 percent) and lone white whales (approximately 60 percent) present during pile driving than before pile driving (Kendall and Cornick, 2015).

During PCT and SFD construction monitoring, behaviors of CIBWs groups were compared by month and by construction activity (61N Environmental, 2021, 2022a, 2022b). Little variability was evident in the behaviors recorded from month to month, or between sightings that coincided with in-water pile installation and removal and those that did not (61N Environmental, 2021, 2022a). Definitive behavioral reactions to in-water pile driving or avoidance behaviors were not documented; however, potential reactions (where a group reversed its trajectory shortly after the start of in-water pile driving occurred; a group reversed its trajectory as it got closer to the sound source during active in-water pile driving; or upon an initial sighting, a group was already moving away from in-water pile driving, raising the possibility that it had been moving towards, but was only sighted after they turned away) and instances where CIBWs moved toward active in-water pile driving were recorded. During these instances, impact driving appeared to cause potential behavioral reactions more readily than vibratory hammering (61N Environmental, 2021, 2022a, 2022b). One minor difference documented during PCT construction was a slightly higher incidence of milling behavior and diving during the periods of no pile driving and slightly higher rates of traveling behavior during periods when potential CIBW behavioral reactions to pile driving, as described above, were recorded (61N Environmental, 2021, 2022a). Note, narratives of each CIBW reaction can be found in the appendices of the POA's final monitoring reports (61N Environmental, 2021, 2022a, 2022b).

Acoustically, Saxon-Kendall *et al.* (2013) recorded echolocation clicks (which can be indicative of feeding behavior) during the MTR Project at the POA both while pile driving was occurring and when it was not. This indicates that while feeding is not a predominant behavior observed in CIBWs sighted near the POA (61N Environmental, 2021, 2022a, 2022b, 2022c; Easley-Appleyard and Leonard, 2022) CIBWs can and still exhibit feeding behaviors during pile driving activities. In addition, Castellote *et al.* (2020) found low echolocation detection rates in lower Knik Arm (*i.e.,* Six Mile, Port MacKenzie, and Cairn Point) and suggested that CIBWs moved through that area relatively quickly when entering or exiting the Arm. No whistles or noisy vocalizations were recorded during the MTR construction activities; however, it is possible that persistent noise associated with construction activity at the MTR project masked beluga vocalizations and or that CIBWs did not use these communicative signals when they were near the MTR Project (Saxon-Kendall *et al.,* 2013).

Recently, McHuron *et al.* (2023) developed a model to predict general patterns related to the movement and foraging decisions of pregnant CIBWs in Cook Inlet. They found that the effects of disturbance from human activities, such as pile driving activities occurring at the POA assuming no prescribed mitigation measures implemented, are inextricably linked with prey availability. If prey are abundant during the summer and early fall, and prey during winter is above some critical threshold, pregnant CIBWs can likely cope with intermittent disruptions, such as those produced by pile driving at the POA (McHuron *et al.,* 2023). However, they stress that more information needs to be acquired regarding CIBW prey and CIBW body condition, specifically in their critical habitat, to better understand possible behavioral responses to disturbance.

Stress responses. An animal's perception of a threat may be sufficient to trigger stress responses consisting of some combination of behavioral responses, autonomic nervous system responses, neuroendocrine responses, or immune responses (*e.g.,* Selye, 1950; Moberg, 2000). In many cases, an animal's first and sometimes most economical (in terms of energetic costs) response is behavioral avoidance of the potential stressor. Autonomic nervous system responses to stress typically involve changes in heart rate, blood pressure, and gastrointestinal activity. These responses have a relatively short duration and may or may not have a significant long-term effect on an animal's fitness.

Neuroendocrine stress responses often involve the hypothalamus-pituitary-adrenal system. Virtually all neuroendocrine functions that are affected by stress—including immune competence, reproduction, metabolism, and behavior—are regulated by pituitary hormones. Stress-induced changes in the secretion of pituitary hormones have been implicated in failed reproduction, altered metabolism, reduced immune competence, and behavioral disturbance (*e.g.,* Moberg, 1987; Blecha, 2000). Increases in the circulation of glucocorticoids are also equated with stress (Romano *et al.,* 2004).

The primary distinction between stress (which is adaptive and does not normally place an animal at risk) and ''distress'' is the cost of the response. During a stress response, an animal uses glycogen stores that can be quickly replenished once the stress is alleviated. In such circumstances, the cost of the stress response would not pose serious fitness consequences. However, when an animal does not have sufficient energy reserves to satisfy the energetic costs of a stress response, energy resources must be diverted from other functions. This state of distress will last until the animal replenishes its energetic reserves sufficient to restore normal function.

Relationships between these physiological mechanisms, animal behavior, and the costs of stress responses are well-studied through controlled experiments and for both laboratory and free-ranging animals (*e.g.,* Holberton *et al.,* 1996; Hood *et al.,* 1998; Jessop *et al.,* 2003; Krausman *et al.,* 2004; Lankford *et al.,* 2005). Stress responses due to exposure to anthropogenic sounds or other stressors and their effects on marine mammals have also been reviewed (Fair and Becker, 2000; Romano *et al.,* 2002b) and, more rarely, studied in wild populations (*e.g.,* Romano *et al.,* 2002a). For example, Rolland *et al.* (2012) found that noise reduction from reduced ship traffic in the Bay of Fundy was associated with decreased stress in North Atlantic right whales. These and other studies lead to a reasonable expectation that some marine mammals will experience physiological stress responses upon exposure to acoustic stressors and that it is possible that some of these would be classified as ''distress.'' In addition, any animal experiencing TTS would likely also experience stress responses (NRC, 2005), however distress is an unlikely result of this project based on observations of marine mammals during previous, similar construction projects.

Norman (2011) reviewed environmental and anthropogenic stressors for CIBWs. Lyamin *et al.* (2011) determined that the heart rate of a beluga whale increases in response to noise, depending on the frequency and intensity. Acceleration of heart rate in the beluga whale is the first component of the ''acoustic startle response.'' Romano *et al.* (2004) demonstrated that captive beluga whales exposed to high-level impulsive sounds (*i.e.,* seismic airgun and/or single pure tones up to 201 dB RMS) resembling sonar pings showed increased stress hormone levels of norepinephrine, epinephrine, and dopamine when TTS was reached. Thomas *et al.* (1990) exposed beluga whales to playbacks of an oil-drilling platform in operation (''Sedco 708,'' 40 Hz–20 kHz; source level 153 dB). Ambient SPL at ambient conditions in the pool before playbacks was 106 dB and 134 to 137 dB RMS during playbacks at the monitoring hydrophone across the pool. All cell and platelet counts and 21 different blood chemicals, including epinephrine and norepinephrine, were within normal limits throughout baseline and playback periods, and stress response hormone levels did not increase immediately after playbacks. The difference between the Romano *et al.* (2004) and Thomas *et al.* (1990) studies could be the differences in the type of sound (seismic airgun and/or tone versus oil drilling), the intensity and duration of the sound, the individual's response, and the surrounding circumstances of the individual's environment. The construction sounds in the Thomas *et al.* (1990) study would be more similar to those of pile installation than those in the study investigating stress response to water guns and pure tones. Therefore, no more than short-term, low-hormone stress responses, if any, of beluga whales or other marine mammals are expected as a result of exposure to in-water pile installation and removal during the NES1 project.

Auditory Masking. Since many marine mammals rely on sound to find prey, moderate social interactions, and facilitate mating (Tyack, 2008), noise from anthropogenic sound sources can interfere with these functions, but only if the noise spectrum overlaps with the hearing sensitivity of the receiving marine mammal (Southall *et al.,* 2007; Clark *et al.,* 2009; Hatch *et al.,* 2012). Chronic exposure to excessive, though not high-intensity, noise could cause masking at particular frequencies for marine mammals that utilize sound for vital biological functions (Clark *et al.,* 2009). Acoustic masking is when other noises such as from human sources interfere with an animal's ability to detect, recognize, or discriminate between acoustic signals of interest (*e.g.,* those used for intraspecific communication and social interactions, prey detection, predator avoidance, navigation) (Richardson *et al.,* 1995; Erbe *et al.,* 2016). Therefore, under certain circumstances, marine mammals whose acoustical sensors or environment are being severely masked could also be impaired from maximizing their performance fitness in survival and reproduction. The ability of a noise source to mask biologically important sounds depends on the characteristics of both the noise source and the signal of interest (*e.g.,* signal-to-noise ratio, temporal variability, direction), in relation to each other and to an animal's hearing abilities (*e.g.,* sensitivity, frequency range, critical ratios, frequency discrimination, directional discrimination, age or TTS hearing loss), and existing ambient noise and propagation conditions (Hotchkin and Parks, 2013).

Under certain circumstances, marine mammals experiencing significant masking could also be impaired from maximizing their performance fitness in survival and reproduction. Therefore, when the coincident (masking) sound is human-made, it may be considered harassment when disrupting or altering critical behaviors. It is important to distinguish TTS and PTS, which persist after the sound exposure, from masking, which occurs during the sound exposure. Because masking (without resulting in TS) is not associated with abnormal physiological function, it is not considered a physiological effect, but rather a potential behavioral effect (though not necessarily one that would be associated with harassment).

The frequency range of the potentially masking sound is important in determining any potential behavioral impacts. For example, low-frequency signals may have less effect on high-frequency echolocation sounds produced by odontocetes but are more likely to affect detection of mysticete communication calls and other potentially important natural sounds such as those produced by surf and some prey species. The masking of communication signals by anthropogenic noise may be considered as a reduction in the communication space of animals (*e.g.,* Clark *et al.,* 2009) and may result in energetic or other costs as animals change their vocalization behavior (*e.g.,* Miller *et al.,* 2000; Foote *et al.,* 2004; Parks *et al.,* 2007; Di Iorio and Clark, 2010; Holt *et al.,* 2009). Masking can be reduced in situations where the signal and noise come from different directions (Richardson *et al.,* 1995), through amplitude modulation of the signal, or through other compensatory behaviors (Hotchkin and Parks, 2013). Masking can be tested directly in captive species (*e.g.,* Erbe, 2008), but in wild populations it must be either modeled or inferred from evidence of masking compensation. There are few studies addressing real-world masking sounds likely to be experienced by marine mammals in the wild (*e.g.,* Branstetter *et al.,* 2013).

Marine mammals at or near the proposed NES1 project site may be exposed to anthropogenic noise which may be a source of masking. Vocalization changes may result from a need to compete with an increase in background noise and include increasing the source level, modifying the frequency, increasing the call repetition rate of vocalizations, or ceasing to vocalize in the presence of increased noise (Hotchkin and Parks, 2013). For example, in response to loud noise, beluga whales may shift the frequency of their echolocation clicks to prevent masking by anthropogenic noise (Tyack, 2000; Eickmeier and Vallarta, 2022).

Masking is more likely to occur in the presence of broadband, relatively continuous noise sources such as vibratory pile driving. Energy distribution of pile driving covers a broad frequency spectrum, and sound from pile driving would be within the audible range of pinnipeds and cetaceans present in the proposed action area. While some construction during the POA's activities may mask some acoustic signals that are relevant to the daily behavior of marine mammals, the short-term duration and limited areas affected make it very unlikely that the fitness of individual marine mammals would be impacted.

Airborne Acoustic Effects. Pinnipeds that occur near the project site could be exposed to airborne sounds associated with construction activities that have the potential to cause behavioral harassment, depending on their distance from these activities. Airborne noise would primarily be an issue for pinnipeds that are swimming or hauled out near the project site within the range of noise levels elevated above airborne acoustic harassment criteria. Although pinnipeds are known to haul-out regularly on man-made objects, we believe that incidents of take resulting solely from airborne sound are unlikely given there are no known pinniped haulout or pupping sites within the vicinity of the proposed project area; the nearest known pinniped haulout is located a minimum of 24 km south-southwest of Anchorage for harbor seals. Cetaceans are not expected to be exposed to airborne sounds that would result in harassment as defined under the MMPA.

We recognize that pinnipeds in the water could be exposed to airborne sound that may result in behavioral harassment when looking with their heads above water. Most likely, airborne sound would cause behavioral responses similar to those discussed above in relation to underwater sound. For instance, anthropogenic sound could cause hauled-out pinnipeds to exhibit changes in their normal behavior, such as reduction in vocalizations, or cause them to temporarily abandon the area and move further from the source. However, these animals would previously have been 'taken' because of exposure to underwater sound above the behavioral harassment thresholds, which are in all cases larger than those associated with airborne sound. Thus, the behavioral harassment of these animals is already accounted for in these estimates of potential take. Therefore, we do not believe that authorization of incidental take resulting from airborne sound for pinnipeds is warranted, and airborne sound is not discussed further here.

Potential Effects on Marine Mammal Habitat

The proposed project will occur within the same footprint as existing marine infrastructure. The nearshore and intertidal habitat where the proposed project will occur is an area of relatively high marine vessel traffic. Temporary, intermittent, and short-term habitat alteration may result from increased noise levels during the proposed construction activities. Effects on prey species will be limited in time and space.

Removal of the North Extension bulkhead and impounded fill would result in restoration of subtidal and intertidal habitats that were lost when that structure was constructed in 2005–2011. Removal of approximately 1.35 million CY of fill material from below the high tide line would re-create approximately 0.05 km^2 (13 acres) of intertidal and subtidal habitat, returning them to their approximate original slope and shoreline configuration. The proposed project area is not considered to be high-quality habitat for marine mammals or marine mammal prey, such as fish, and it is anticipated that the removal of the North Extension bulkhead would increase the amount of available habitat for both marine mammals and fish because they would be able to swim through the area at higher water levels. The area is expected to be of higher quality to marine mammals and fish as it returns to its natural state and is colonized by marine organisms.

Water quality—Temporary and localized reduction in water quality would occur as a result of in-water construction activities. Most of this effect would occur during the installation and removal of piles when bottom sediments are disturbed. The installation and removal of piles would disturb bottom sediments and may cause a temporary increase in suspended sediment in the project area. During pile removal, sediment attached to the pile moves vertically through the water column until gravitational forces cause it to slough off under its own weight. The small resulting sediment plume is expected to settle out of the water column within a few hours. Studies of the effects of turbid water on fish (marine mammal prey) suggest that concentrations of suspended sediment can reach thousands of milligrams per liter before an acute toxic reaction is expected (Burton, 1993).

Effects to turbidity and sedimentation are expected to be short-term, minor, and localized. Since the currents are so strong in the area, following the completion of sediment-disturbing activities, suspended sediments in the water column should dissipate and quickly return to background levels in all construction scenarios. Turbidity within the water column has the potential to reduce the level of oxygen in the water and irritate the gills of prey fish species in the proposed project area. However, turbidity plumes associated with the project would be temporary and localized, and fish in the proposed project area would be able to move away from and avoid the areas where plumes may occur. Therefore, it is expected that the impacts on prey fish species from turbidity, and therefore on marine mammals, would be minimal and temporary. In general, the area likely impacted by the proposed construction activities is relatively small compared to the available marine mammal habitat in Knik Arm.

Potential Effects on Prey. Sound may affect marine mammals through impacts on the abundance, behavior, or distribution of prey species (*e.g.,* crustaceans, cephalopods, fishes, zooplankton). Marine mammal prey varies by species, season, and location and, for some, is not well documented. Studies regarding the effects of noise on known marine mammal prey are described here.

Fishes utilize the soundscape and components of sound in their environment to perform important functions such as foraging, predator avoidance, mating, and spawning (*e.g.,* Zelick *et al.,* 1999; Fay, 2009). Depending on their hearing anatomy and peripheral sensory structures, which vary among species, fishes hear sounds using pressure and particle motion sensitivity capabilities and detect the motion of surrounding water (Fay *et al.,* 2008). The potential effects of noise on fishes depends on the overlapping frequency range, distance from the sound source, water depth of exposure, and species-specific hearing sensitivity, anatomy, and physiology. Key impacts to fishes may include behavioral responses, hearing damage, barotrauma (pressure-related injuries), and mortality.

Fish react to sounds that are especially strong and/or intermittent low-frequency sounds. Short duration, sharp sounds can cause overt or subtle changes in fish behavior and local distribution. The reaction of fish to noise depends on the physiological state of the fish, past exposures, motivation (*e.g.,* feeding, spawning, migration), and other environmental factors. Hastings and Popper (2005) identified several studies that suggest fish may relocate to avoid certain areas of sound energy. Additional studies have documented effects of pile driving on fishes (*e.g.* Scholik and Yan, 2001, 2002; Popper and Hastings, 2009). Several studies have demonstrated that impulsive sounds might affect the distribution and behavior of some fishes, potentially impacting foraging opportunities or increasing energetic costs (*e.g.,* Fewtrell and McCauley, 2012; Pearson *et al.,* 1992; Skalski *et al.,* 1992; Santulli *et al.,* 1999; Paxton *et al.,* 2017). However, some studies have shown no or slight reaction to impulse sounds (*e.g.,* Peña *et al.,* 2013; Wardle *et al.,* 2001; Jorgenson and Gyselman, 2009; Cott *et al.,* 2012). More commonly, though, the impacts of noise on fishes are temporary.

During the POA's MTRP, the effects of impact and vibratory installation of 30-inch (76-cm) steel sheet piles at the POA on 133 caged juvenile coho salmon in Knik Arm were studied (Hart Crowser Incorporated *et al.,* 2009; Houghton *et al.,* 2010). Acute or delayed mortalities, or behavioral abnormalities were not observed in any of the coho salmon. Furthermore, results indicated that the pile driving had no adverse effect on feeding ability or the ability of the fish to respond normally to threatening stimuli (Hart Crowser Incorporated *et al.,* 2009; Houghton *et al.,* 2010).

SPLs of sufficient strength have been known to cause injury to fishes and fish mortality (summarized in Popper *et al.,* 2014). However, in most fish species, hair cells in the ear continuously regenerate and loss of auditory function likely is restored when damaged cells are replaced with new cells. Halvorsen *et al.* (2012b) showed that a TTS of 4 to 6 dB was recoverable within 24 hours for one species. Impacts would be most severe when the individual fish is close to the source and when the duration of exposure is long. Injury caused by barotrauma can range from slight to severe and can cause death, and is most likely for fish with swim bladders. Barotrauma injuries have been documented during controlled exposure to impact pile driving (Halvorsen *et al.,* 2012a; Casper *et al.,* 2013, 2017).

Fish populations in the proposed project area that serve as marine mammal prey could be temporarily affected by noise from pile installation and removal. The frequency range in which fishes generally perceive underwater sounds is 50 to 2,000 Hz, with peak sensitivities below 800 Hz (Popper and Hastings, 2009). Fish behavior or distribution may change, especially with strong and/or intermittent sounds that could harm fishes. High underwater SPLs have been documented to alter behavior, cause hearing loss, and injure or kill individual fish by causing serious internal injury (Hastings and Popper, 2005).

Essential Fish Habitat (EFH) has been designated in the estuarine and marine waters in the vicinity of the proposed project area for all five species of salmon (*i.e.,* chum salmon, pink salmon, coho salmon, sockeye salmon, and Chinook salmon; North Pacific Fishery Management Council (NPFMC), 2020, 2021), which are common prey of marine mammals, as well as for other species. (NPFMC, 2020). However, there are no designated habitat areas of particular concern in the vicinity of the Port, and therefore, adverse effects on EFH in this area are not expected.

The greatest potential impact to fishes during construction would occur during impact pile removal. However, the use of impact pile driving would be limited to situations when sheet piles remain seized in the sediments and cannot be loosened or broken free with a vibratory hammer. Further, use of an impact hammer to dislodge piles is expected to be uncommon, with a limited number of up to 150 strikes (an estimated 50 strikes per pile for up to three piles) on any individual day or approximately 5 percent of active hammer duration for sheet pile. In-water construction activities would only occur during daylight hours, allowing fish to forage and transit the project area in the evening. Vibratory pile driving would possibly elicit behavioral reactions from fishes such as temporary avoidance of the area but is unlikely to cause injuries to fishes or have persistent effects on local fish populations. Construction also would have minimal permanent and temporary impacts on benthic invertebrate species, a marine mammal prey source. In addition, it should be noted that the area in question is low-quality habitat since it is already highly developed and experiences a high level of anthropogenic noise from normal operations and other vessel traffic at the POA.

Fish species in Knik Arm, including those that are prey for marine mammals, are expected to benefit from removal of the North Extension bulkhead and availability of the resulting exposed subtidal and intertidal habitat. NES1 is not anticipated to impede migration of adult or juvenile salmon or to adversely affect the health and survival of the affected species at the population level. Once in-water pile installation and removal has ceased and NES1 is complete, the newly available habitat is expected to transition back to its original, more natural condition and provide foraging, migrating, and rearing habitats to fish and foraging habitat to marine mammals. In general, any negative impacts on marine mammal prey species are expected to be minor and temporary.

In-Water Construction Effects on Potential Foraging Habitat

The NES1 Project area has not been considered to be high-quality habitat for marine mammals or marine mammal prey, such as fish, and it is anticipated that the long-term impact on marine mammals associated with NES1 would be a permanent increase in potential habitat because of the removal of the North Extension bulkhead, restoring access of the area to marine mammals and fish. The NES1 project is not expected to result in any habitat related effects that could cause significant or long-term negative consequences for individual marine mammals or their populations, since installation and removal of in-water piles would be temporary and intermittent, and the re-creation of intertidal and subtidal habitats would be permanent. Therefore, impacts of the project are not likely to have adverse effects on marine mammal foraging habitat in the proposed project area.

Estimated Take

This section provides an estimate of the number of incidental takes proposed for authorization through the IHA, which will inform both NMFS' consideration of ''small numbers,'' and the negligible impact determinations.

Harassment is the only type of take expected to result from these activities. Except with respect to certain activities not pertinent here, section 3(18) of the

MMPA defines ''harassment'' as any act of pursuit, torment, or annoyance, which (i) has the potential to injure a marine mammal or marine mammal stock in the wild (Level A harassment); or (ii) has the potential to disturb a marine mammal or marine mammal stock in the wild by causing disruption of behavioral patterns, including, but not limited to, migration, breathing, nursing, breeding, feeding, or sheltering (Level B harassment).

Authorized takes would primarily be by Level B harassment, as use of the acoustic sources (*i.e.,* vibratory and impact pile driving) has the potential to result in disruption of behavioral patterns for individual marine mammals. There is also some potential for auditory injury (Level A harassment) to result, primarily for high frequency cetaceans and phocids because predicted auditory injury zones are larger than for mid-frequency cetaceans and otariids. Auditory injury is unlikely to occur for mysticetes, mid-frequency cetaceans, and otariids due to measures described in the Proposed Mitigation section. The proposed mitigation and monitoring measures are expected to minimize the severity of the taking to the extent practicable. As described previously, no serious injury or mortality is anticipated or proposed to be authorized for this activity. Below we describe how the proposed take numbers are estimated.

For acoustic impacts, generally speaking, we estimate take by considering: (1) acoustic thresholds above which NMFS believes the best available science indicates marine mammals will be behaviorally harassed or incur some degree of permanent hearing impairment; (2) the area or volume of water that will be ensonified above these levels in a day; (3) the density or occurrence of marine mammals within these ensonified areas; and, (4) the number of days of activities. We note that while these factors can contribute to a basic calculation to provide an initial prediction of potential takes, additional information that can qualitatively inform take estimates is also sometimes available (*e.g.,* previous monitoring results or average group size). Below, we describe the factors considered here in more detail and present the proposed take estimates.

Acoustic Thresholds

NMFS recommends the use of acoustic thresholds that identify the received level of underwater sound above which exposed marine mammals would be reasonably expected to be behaviorally harassed (equated to Level B harassment) or to incur PTS of some degree (equated to Level A harassment).

Level B Harassment—Though significantly driven by received level, the onset of behavioral disturbance from anthropogenic noise exposure is also informed to varying degrees by other factors related to the source or exposure context (*e.g.,* frequency, predictability, duty cycle, duration of the exposure, signal-to-noise ratio, distance to the source), the environment (*e.g.,* bathymetry, other noises in the area, predators in the area), and the receiving animals (hearing, motivation, experience, demography, life stage, depth) and can be difficult to predict (*e.g.,* Southall *et al.,* 2007, 2021; Ellison *et al.,* 2012). Based on what the available science indicates and the practical need to use a threshold based on a metric that is both predictable and measurable for most activities, NMFS typically uses a generalized acoustic threshold based on received level to estimate the onset of behavioral harassment. NMFS generally predicts that marine mammals are likely to be behaviorally harassed in a manner considered to be Level B harassment when exposed to underwater anthropogenic noise above root-mean-squared pressure received levels (RMS SPL) of 120 dB re 1 μPa for continuous (*e.g.,* vibratory pile driving, drilling) and above RMS SPL 160 dB re 1 μPa for non-explosive impulsive (*e.g.,* seismic airguns) or intermittent (*e.g.,* scientific sonar) sources. Generally speaking, Level B harassment take estimates based on these behavioral harassment thresholds are expected to include any likely takes by TTS as, in most cases, the likelihood of TTS occurs at distances from the source less than those at which behavioral harassment is likely. TTS of a sufficient degree can manifest as behavioral harassment, as reduced hearing sensitivity and the potential reduced opportunities to detect important signals (conspecific communication, predators, prey) may result in changes in behavior patterns that would not otherwise occur.

The POA's proposed activity includes the use of continuous (vibratory pile driving) and intermittent (impact pile driving) noise sources, and therefore the RMS SPL thresholds of 120 and 160 dB re 1 μPa are applicable.

Level A harassment. NMFS' Technical Guidance for Assessing the Effects of Anthropogenic Sound on Marine Mammal Hearing (Version 2.0; NMFS, 2018) identifies dual criteria to assess auditory injury (Level A harassment) to five different marine mammal groups (based on hearing sensitivity) as a result of exposure to noise from two different types of sources (impulsive or non-impulsive). The POA's proposed activity includes the use of impulsive (impact pile driving) and non-impulsive (vibratory driving) sources.

These thresholds are provided in the table below. The references, analysis, and methodology used in the development of the thresholds are described in NMFS' 2018 Technical Guidance, which may be accessed at: *https://www.fisheries.noaa.gov/national/marine-mammal-protection/marine-mammal-acoustic-technical-guidance.*

TABLE 6—THRESHOLDS IDENTIFYING THE ONSET OF PERMANENT THRESHOLD SHIFT

Hearing Group	PTS onset acoustic thresholds* (received level)	
	Impulsive	Non-impulsive
Low-Frequency (LF) Cetaceans	*Cell 1:* $L_{pk,flat}$: 219 dB; $L_{E,LF,24h}$: 183 dB	*Cell 2:* $L_{E,LF,24h}$: 199 dB.
Mid-Frequency (MF) Cetaceans	*Cell 3:* $L_{pk,flat}$: 230 dB; $L_{E,MF,24h}$: 185 dB	*Cell 4:* $L_{E,MF,24h}$: 198 dB.
High-Frequency (HF) Cetaceans	*Cell 5:* $L_{pk,flat}$: 202 dB; $L_{E,HF,24h}$: 155 dB	*Cell 6:* $L_{E,HF,24h}$: 173 dB.
Phocid Pinnipeds (PW) (Underwater)	*Cell 7:* $L_{pk,flat}$: 218 dB; $L_{E,PW,24h}$: 185 dB	*Cell 8:* $L_{E,PW,24h}$: 201 dB.
Otariid Pinnipeds (OW) (Underwater)	*Cell 9:* $L_{pk,flat}$: 232 dB; $L_{E,OW,24h}$: 203 dB	*Cell 10:* $L_{E,OW,24h}$: 219 dB.

* Dual metric acoustic thresholds for impulsive sounds: Use whichever results in the largest isopleth for calculating PTS onset. If a non-impulsive sound has the potential of exceeding the peak sound pressure level thresholds associated with impulsive sounds, these thresholds should also be considered.

Note: Peak sound pressure (L_{pk}) has a reference value of 1 μPa, and cumulative sound exposure level (L_E) has a reference value of 1μPa²s. In this Table, thresholds are abbreviated to reflect American National Standards Institute standards (ANSI, 2013). However, peak sound pressure is defined by ANSI as incorporating frequency weighting, which is not the intent for NMFS' 2018 Technical Guidance. Hence, the subscript "flat" is being included to indicate peak sound pressure should be flat weighted or unweighted within the generalized hearing range. The subscript associated with cumulative sound exposure level thresholds indicates the designated marine mammal auditory weighting function (LF, MF, and HF cetaceans, and PW and OW pinnipeds) and that the recommended accumulation period is 24 hours. The cumulative sound exposure level thresholds could be exceeded in a multitude of ways (*i.e.,* varying exposure levels and durations, duty cycle). When possible, it is valuable for action proponents to indicate the conditions under which these acoustic thresholds will be exceeded.

Ensonified Area

Here, we describe operational and environmental parameters of the activity that are used in estimating the area ensonified above the acoustic thresholds, including source levels and transmission loss coefficient.

The sound field in the project area is the existing background noise plus additional construction noise from the proposed project. Marine mammals are expected to be affected via sound generated by the primary components of the project (*i.e.,* impact pile removal and vibratory pile installation and removal). Calculation of the area ensonified by the proposed action is dependent on the background sound levels at the project site, the source levels of the proposed activities, and the estimated transmission loss coefficients for the proposed activities at the site. These factors are addressed in order, below.

Background Sound Levels at the Port of Alaska. As noted in the Potential Effects of Specified Activities on Marine Mammals and Their Habitat Section of this notice, the POA is an industrial facility in a location with high levels of commercial vessel traffic, port operations (including dredging), and extreme tidal flow. Previous measurements of background noise at the POA have recorded a background SPL of 122.2 dB RMS (Austin *et al.,* 2016). NMFS concurs that this SPL reasonably represents background noise near the proposed project area, and therefore we have used 122.2 dB RMS as the threshold for Level B harassment (instead of 120 dB RMS).

Sound Source Levels of Proposed Activities. The intensity of pile driving sounds is greatly influenced by factors such as the type of piles (material and diameter), hammer type, and the physical environment (*e.g.,* sediment type) in which the activity takes place. In order to calculate the distances to the Level A harassment and the Level B harassment sound thresholds for the methods and piles being used in this project, the POA used acoustic monitoring data from sound source verification studies to develop proxy source levels for the various pile types, sizes and methods (Table 7). While site-specific sound source verification studies have been conducted at the POA, the vast majority of the measurements recorded in those studies were made when bubble curtains were deployed around the sound source, which act to attenuate sound levels (Austin *et al.,* 2016; I&R, 2021a, 2021b). Bubble curtains are not a feasible mitigation measure for the NES1 project due to the demolition and sequencing nature of the project (see the Proposed Mitigation section of this notice for additional discussion), and therefore the majority of the proposed proxy values for this project are based on measurements recorded from locations other than the POA.

Underwater sound was measured in 2008 at the POA for the MTRP during installation of sheet piles to assess potential impacts of sound on marine species. Sound levels for installation of sheet piles measured at 10 m typically ranged from 147 to 161 dB RMS, with a mean of approximately 155 dB RMS (James Reyff, unpublished data). An SSL of 162 dB RMS was reported in (CALTRANS, 2020) summary tables for 24-inch steel sheet piles. This is a more rigid type of sheet pile that requires a large vibratory driver (James Reyff, personal communication, August 26, 2020). Based on the 2008 measurements at the POA and the CALTRANS data, a value of 160 dB RMS was assumed for vibratory removal of sheet piles.

NMFS concurs that the source levels proposed by the POA for all pile sizes during impact hammering activities and vibratory installation of all pile types are appropriate to use for calculating harassment isopleths for the POA's proposed NES1 activities (Table 7). However, the source levels proposed by the POA for vibratory pile removal were based on limited data collected at the POA. Therefore, NMFS considered and evaluated all data related to unattenuated vibratory removal of 24-inch (61-cm) and 36-inch (91-cm) steel pipe piles available, including sound source verification data measured at the POA during the PCT project (Reyff *et al,* 2021a) and elsewhere (*i.e.,* Coleman, 2011; U.S. Navy, 2012; I&R, 2017). NMFS gathered data from publicly available reports that reported driving conditions and specified vibratory removal for certain piles. If vibratory removal was not specifically noted for a given pile, we excluded that data from the analysis. Mean RMS SPLs reported by these studies were converted into pressure values, and pressure values for piles from each project were averaged to give a single SPL for each project. The calculated project means were then averaged and converted back into dBs to give a single recommended SPL for each pile type.

Ten measurements were available for unattenuated vibratory removal of 24-inch (61-cm) piles: 3 from Columbia River Crossing in Oregon (mean RMS SPL of 172.4 dB; Coleman, 2011), 5 from Joint Expeditionary Base Little Creek in Norfolk, Virginia (mean RMS SPL of 148.2 dB; I&R, 2017), and 2 from the PCT project at the POA (mean RMS SPL of 168.7 dB; I&R, 2021a, 2023). The calculated average SPL for unattenuated vibratory removal of 24-inch (61-cm) steel pipe piles from these studies was 168 dB RMS (Table 7). Forty measurements were available for unattenuated vibratory removal of 36-inch (91-cm) piles: 38 from the U.S. Navy Test Pile Program at Naval Base Kitsap in Bangor, Washington (mean RMS SPL of 159.4 dB; U.S. Navy, 2012), and 2 from the PCT project at the POA (mean RMS SPL of 158.5 dB; I&R, 2021, 2023). The calculated average SPL for unattenuated vibratory removal of 36-inch (91-cm) steel pipe piles from these studies was 159 dB RMS (Table 7). Note that the proxy values in Table 7 represent SPL referenced at a distance of 10 m from the source. Interestingly, the RMS SPLs for the unattenuated vibratory removal of 24-inch (61-cm) piles was much louder than the unattenuated vibratory removal of 36-inch piles (91-cm), and even louder than the unattenuated vibratory installation of 24-inch piles. I&R (2023) suggest that at least for data recorded at the POA, the higher 24-inch (61-cm) removal levels are likely due to the piles being removed at rates of 1,600 to 1,700 revolutions per minute (rpm), while 36-inch (91-cm) piles, which are significantly heavier than 24-inch (61-cm) piles), were removed at a rate of 1,900 rpm. The slower rates combined with the lighter piles would cause the hammer to easily "jerk" or excite the 24-inch (61-cm) piles as they were extracted, resulting in a louder rattling sound and louder sound levels. This did not occur for the 36-inch (91-cm) piles, which were considerably heavier due to increased diameter, longer length, and greater thickness.

TABLE 7—SUMMARY OF UNATTENUATED IN-WATER PILE DRIVING PROXY LEVELS

[at 10 m]

Pile type	Installation or removal	Peak SPL (re 1 μPa)	RMS SPL (re 1 μPa)	SEL (re 1 μPa²-sec)	Source
Impact driving:					
Sheet pile	Removal	205	189	179	CALTRANS (2020).
Vibratory driving:					
Sheet pile	Removal (hammer or splitter)	NA	160	NA	CALTRANS (2015, 2020).
24-inch (61-cm) steel pipe.	Installation		161		U.S. Navy (2015).
	Removal		168		Coleman (2011), I&R (2017, 2021, 2023).
36-inch (91-cm steel pipe).	Installation		166		U.S. Navy (2015).
	Removal		159		U.S. Navy (2012), I&R (2021, 2023).

The POA assumes that a pile splitter would produce the same or similar sound levels as a vibratory hammer without the splitter attachment; therefore, the POA combined use of a vibratory hammer to remove sheet pile and use of a splitter into a single category (*i.e.,* vibratory hammer removal). NMFS is currently unaware of any hydroacoustic measurements of pile splitting with a vibratory hammer. Without additional data, NMFS preliminary accepts the POAs proposed SPLs and assessments. However, NMFS specifically requests comments on the proposed SPL values for vibratory pile splitting. If available, NMFS requests recommendations for available data on underwater measurements and potential impacts of these construction activities.

Transmission Loss. For unattenuated impact pile driving, the POA proposed to use 15 as the *TL* coefficient, meaning they assume practical spreading loss (*i.e.,* the POA assumes $TL = 15*Log_{10}(range)$); NMFS concurs with this value and has used the practical spreading loss model for impact driving in this analysis.

The *TL* coefficient that the POA proposed for unattenuated vibratory installation and removal of piles is 16.5 (*i.e.,* $TL = 16.5*Log_{10}(range)$). This value is an average of measurements obtained from two 48-in (122-cm) piles installed via an unattenuated vibratory hammer in 2016 (Austin *et al.,* 2016). To assess the appropriateness of this *TL* coefficient to be used for the proposed project, NMFS examined and analyzed additional *TL* measurements recorded at the POA. This includes a *TL* coefficient of 22 (deep hydrophone measurement) from the 2004 unattenuated vibratory installation of one 36-inch (91-cm) pile in Knik Arm (Blackwell, 2004), as well as *TL* coefficients ranging from 10.3 to 18.2 from the unattenuated vibratory removal of 24-inch (61 cm) and 36-inch (91-cm) piles and the unattenuated vibratory installation of one 48-in (122-cm) pile at the POA in 2021 (I&R 2021, 2023). To account for statistical interdependence due to temporal correlations and equipment issues across projects, values were averaged first within each individual project, and then across projects. The mean and median value of the measured *TL* coefficients for unattenuated vibratory piles in Knik Arm by project are equal to 18.9 and 16.5, respectively. NMFS proposes the use of the project median *TL* coefficient of 16.5 during unattenuated vibratory installation and removal of all piles during the NES1 project. This value is representative of all unattenuated vibratory measurements in the Knik Arm. Further, 16.5 is the mean of the 2016 measurements, which were made closer to the NES1 proposed project area than other measurements and were composed of measurements from multiple directions (both north and south/southwest).

Estimated Harassment Isopleths. All estimated Level B harassment isopleths are reported in Table 9. At POA, Level B harassment isopleths from the proposed project will be limited by the coastline along Knik Arm along and across from the project site. The maximum predicted isopleth distance is 5,968 m during vibratory removal of 24-inch (61-cm) steel pipe piles.

The ensonified area associated with Level A harassment is more technically challenging to predict due to the need to account for a duration component. Therefore, NMFS developed an optional User Spreadsheet tool to accompany the Technical Guidance that can be used to relatively simply predict an isopleth distance for use in conjunction with marine mammal density or occurrence to help predict potential takes. We note that because of some of the assumptions included in the methods underlying this optional tool, we anticipate that the resulting isopleth estimates are typically going to be overestimates of some degree, which may result in an overestimate of potential take by Level A harassment. However, this optional tool offers the best way to estimate isopleth distances when more sophisticated modeling methods are not available or practical. For stationary sources such as pile driving, the optional User Spreadsheet tool predicts the distance at which, if a marine mammal remained at that distance for the duration of the activity, it would be expected to incur PTS. Inputs used in the User Spreadsheet are reported in Table 8 and the resulting isopleths and ensonified areas are reported in Table 9.

TABLE 8—NMFS USER SPREADSHEET INPUTS

	Impact pile driving	Vibratory pile driving					
	Sheet pile	Sheet pile	24-inch (61-cm) steel pipe		36-inch (91-cm) steel pipe		
	Removal	Removal	Installation	Removal	Installation	Removal
Spreadsheet Tab Used.	E.1) Impact pile driving.	A.1) Non-Impul, Stat, Cont.	A.1) Non-Impul, Stat, Cont.	A.1) Non-Impul, Stat, Cont.	A.1) Non-Impul, Stat, Cont.	A.1) Non-Impul, Stat, Cont.
Source Level (SPL)	179 dB SEL	160 dB RMS	161 dB RMS	168 dB RMS	166 dB RMS	159 dB RMS.
Transmission Loss Coefficient.	15	16.5	16.5	16.5	16.5	16.5.
Weighting Factor Adjustment (kHz).	2	2.5	2.5	2.5	2.5	2.5.
Time to install/remove single pile (minutes).		5	15	15	15	15.
Number of strikes per pile.	50					
Piles per day	3	24	12	12	12	12.
Distance of sound pressure level measurement (m).	10	10	10	10	10	10.

TABLE 9—CALCULATED DISTANCE AND AREAS OF LEVEL A AND LEVEL B HARASSMENT PER PILE TYPE AND PILE DRIVING METHOD

Activity	Pile type/size	Level A harassment distance (m)					Level B harassment distance (m) all hearing groups	Level B harassment area (km²) all hearing groups
		LF	MF	HF	PW	OW		
Impact Removal	Sheet pile	153	6	182	82	6	858	1.44
Vibratory Installation.	24-inch (61-cm)	14	2	20	9	1	2,247	8.39
	36-inch (91-cm)	28	4	40	18	2	4,514	26.13
Vibratory or Splitter Removal.	Sheet pile	10	1	14	6	1	1,954	6.47
Vibratory Removal	24-inch (61-cm)	37	4	53	24	3	5,968	37.64
	36-inch (91-cm)	11	2	15	7	1	1,700	4.99

Marine Mammal Occurrence and Take Estimation

In this section we provide information about the occurrence of marine mammals, including density or other relevant information which will inform the take calculation. We also describe how the information provided above is synthesized to produce a quantitative estimate of the take that is reasonably likely to occur and proposed for authorization.

Gray Whale

Sightings of gray whales in the proposed project area are rare. Few, if any, gray whales are expected to approach the proposed project area. However, based on three separate sightings of single gray whales near the POA in 2020 and 2021 (61N Environmental, 2021, 2022a; Easley-Appleyard and Leonard, 2022), the POA anticipates that up to six individuals could be within estimated harassment zones during NES1 project activities. Therefore, NMFS proposes to authorize six takes by Level B harassment for gray whales during the NES1 project. Take by Level A harassment is not anticipated or proposed to be authorized. The Level A harassment zones (Table 9) are smaller than the required shutdown zones (see the Proposed Mitigation section). It is unlikely that a gray whale would enter and remain within the Level A harassment zone long enough to incur PTS.

Humpback Whale

Sightings of humpback whales in the proposed project area are rare, and few, if any, humpback whales are expected to approach the proposed project area. However, there have been a few observations of humpback whales near the POA as described in the Description of Marine Mammals in the Area of Specified Activities section of this notice. Based on the two sightings in 2017 of what was likely a single individual at the Anchorage Public Boat Dock at Ship Creek (ABR, Inc., 2017) south of the Project area, the POA requested authorization of six takes of humpback whales. However, given the maximum number of humpback whales observed within a single construction season was two (in 2017), NMFS instead anticipates that only up to four humpback whales could be exposed to project-related underwater noise during the NES1 project. Therefore, NMFS proposes to authorize four takes by Level B harassment for humpback whales during the NES1 project. Take by Level A harassment is not anticipated or proposed to be authorized. The Level A harassment zones (Table 9) are smaller than the required shutdown zones (see the Proposed Mitigation section), therefore, it is unlikely that a humpback whale would enter and remain within the Level A harassment zone long enough to incur PTS.

Killer Whale

Few, if any, killer whales are expected to approach the NES1 project area. No killer whales were sighted during previous monitoring programs for POA construction projects, including the 2016 TPP, 2020 PCT, and 2022 SFD projects (Prevel-Ramos *et al.,* 2006; Markowitz and McGuire, 2007; Cornick and Saxon-Kendall, 2008, 2009; Cornick *et al.,* 2010, 2011; ICRC, 2009, 2010, 2011, 2012; Cornick and Pinney, 2011;

Cornick and Seagars, 2016; 61N Environmental, 2021, 2022b), until PCT construction in 2021, when two killer whales were sighted (61N Environmental, 2022a). Previous sightings of transient killer whales have documented pod sizes in upper Cook Inlet between one and six individuals (Shelden *et al.,* 2003). Therefore, the POA conservatively estimates that no more than one small pod (assumed to be six individuals) could be within estimated harassment zones during NES1 project activities.

Take by Level A harassment is not anticipated or proposed to be authorized due to the implementation of shutdown zones, which would be larger than the Level A harassment zones (described below in the Proposed Mitigation section), and the low likelihood that killer whales would approach this distance for sufficient duration to incur PTS. Therefore, NMFS proposes to authorize six takes by Level B harassment for killer whales.

Harbor Porpoise

Monitoring data recorded from 2005 through 2022 were used to evaluate hourly sighting rates for harbor porpoises in the proposed NES1 area (see Table 4–3 in the POA's application). During most years of monitoring, no harbor porpoises were observed. However, there has been an increase in harbor porpoise sightings in upper Cook Inlet in recent decades (*e.g.,* 61N Environmental, 2021, 2022a; Shelden *et al.,* 2014). The highest sighting rate for any recorded year during in-water pile installation and removal was an average of 0.037 harbor porpoises per hour during PCT construction in 2021, when observations occurred across most months. Given the uncertainty around harbor porpoise occurrence at the POA and potential that occurrence is increasing, it is estimated that approximately 0.07 harbor porpoises per hour (the 2021 rate of 0.037 harbor porpoises per hour doubled) may be observed near the proposed NES1 area per hour of hammer use. With 246.5 hours of in-water pile installation and removal, we estimate that there could be 18 instances where harbor porpoises (0.07 harbor porpoises per hour * 246.5 hours = 17.3 harbor porpoises rounded up to 18 harbor porpoises) could be within estimated harassment zones during NES1 project activities.

Harbor porpoises are small, lack a visible blow, have low dorsal fins, an overall low profile, and a short surfacing time, making them difficult to observe (Dahlheim *et al.,* 2015). To account for the possibility that a harbor porpoise could enter a Level A harassment zone and remain there for sufficient duration to incur PTS before activities were shut down, the POA assumed that 5 percent of estimated harbor porpoise takes (one take of harbor porpoise; 5 percent of 18 = 0.9, rounded up to 1) could be taken by Level A harassment. In its request, the POA rounded this estimate up to two to account for the average group size of this species, However, NMFS has determined such adjustments are generally unnecessary for purposes of estimating potential incidents of Level A harassment and does not concur with the request. At relatively close distances, NMFS believes it unlikely that groups will necessarily adhere to each other for sufficient duration for the entire group to incur PTS. While it is unlikely that a harbor porpoise could enter a Level A harassment zone for sufficient duration to incur PTS given the proposed shutdown measures (see the Proposed Mitigation section for more information) and potential for avoidance behavior, this species moves quickly and can be difficult to detect and track, therefore, NMFS proposes to authorize 1 take by Level A harassment and 17 takes by Level B harassment for harbor porpoises, for a total of 18 instances of take.

Steller Sea Lion

Steller sea lions are anticipated to occur in low numbers within the proposed NES1 project area as summarized in the Description of Marine Mammals in the Area of Specified Activities section. Similar to the approach used above for harbor porpoises, the POA used previously recorded sighting rates of Steller sea lions near the POA to estimate requested take for this species. During SFD construction in May and June of 2022, the hourly sighting rate for Steller sea lions was 0.028. The hourly sighting rate for Steller sea lions in 2021, the most recent year with observations across most months, was approximately 0.01. Given the uncertainty around Steller sea lion occurrence at the POA and potential that occurrence is increasing, the POA estimated that approximately 0.06 Steller sea lions per hour (the May and June 2022 rate of 0.028 Steller sea lions per hour doubled) may be observed near the proposed NES1 project areas per hour of hammer use. With 246.5 hours of in-water pile installation and removal, the POA estimates that 15 Steller sea lions (0.06 sea lions per hour * 246.5 hours = 14.79 sea lions rounded up to 15) could be within estimated harassment zones during NES1 project activities. However, the highest number of Steller sea lions that have been observed during the 2020–2022 monitoring efforts at the POA was nine individuals (eight during PCT Phase 1 monitoring and one during NMFS 2021 monitoring). Given the POA's estimate assumes a higher Steller sea lion sighting rate (0.06) than has been observed at the POA and results in an estimate that is much larger than the number of Steller sea lions observed in a year, NMFS believes that the 15 estimated takes requested by the POA overestimates potential exposures of this species. NMFS instead proposed that nine Steller sea lions may be taken, by Level B harassment only, during the NES1 project.

The largest Level A harassment zone for Steller sea lions is 6 m. While it is unlikely that a Steller sea lion would enter a Level A harassment zone for sufficient duration to incur PTS, the POA is aware of a Steller sea lion that popped up next to a work skiff during the TPP in 2016, which was documented as a potential take by Level A harassment by the PSOs on duty at the time. Pile driving, however, was not occurring at the time the event was recorded and a brief observation of an animal within a Level A harassment zone does not necessarily mean the animal experienced Level A harassment (other factors such as duration within the harassment zone need to be taken into consideration). However, as a result of the aforementioned event, the POA requested authorization of an additional two takes of Steller sea lions by Level A harassment. Given the small Level A harassment zone (6 m), and proposed shutdown zones of ≥ 10 m, NMFS believes that it is unlikely that a Steller sea lion would be within the Level A harassment zone for sufficient duration to incur PTS. Therefore, NMFS does not propose to authorize take by Level A harassment for Steller sea lions. Rather, all 9 estimated takes are assumed to occur by Level B harassment, and no take by Level A harassment is proposed for authorization.

Harbor Seal

No known harbor seal haulout or pupping sites occur in the vicinity of the POA. In addition, harbor seals are not known to reside in the proposed NES1 project area, but they are seen regularly near the mouth of Ship Creek when salmon are running, from July through September. With the exception of newborn pups, all ages and sexes of harbor seals could occur in the NES1 project area. Any harassment of harbor seals during in-water pile installation and removal would involve a limited number of individuals that may potentially swim through the NES1 project area or linger near Ship Creek.

The POA evaluated marine mammal monitoring data to calculate hourly sighting rates for harbor seals in the NES1 project area (see Table 4–1 in the POA's application). Of the 524 harbor seal sightings in 2020 and 2021, 93.7 percent of the sightings were of single individuals; only 5.7 percent of sightings were of two individual harbor seals, and only 0.6 percent of sightings reported three harbor seals. Sighting rates of harbor seals were highly variable and appeared to have increased during monitoring between 2005 and 2022. It is unknown whether any potential increase was due to local population increases or habituation to ongoing construction activities. The highest individual hourly sighting rate recorded for a previous year was used to quantify take of harbor seals for in-water pile installation and removal associated with NES1. This occurred in 2021 during PCT Phase 2 construction, when harbor seals were observed from May through September. A total of 220 harbor seal sightings were observed over 734.9 hours of monitoring, at an average rate of 0.30 harbor seal sightings per hour. The maximum monthly sighting rate occurred in September 2020 and was 0.51 harbor seal sightings per hour. Based on these data, the POA estimated that approximately one harbor seal (the maximum monthly sighting rate (0.51) rounded up) may be observed near the NES1 project per hour of hammer use. This approximate sighting rate of one harbor seal per hour was also used to calculate potential exposures of harbor seals for the SFD project (86 FR 50057, September 7, 2021). Therefore, the POA estimates that during the 246.5 hours of anticipated in-water pile installation and removal, up to 247 harbor seals (1 harbor seal per hour * 246.5 hours = 246.5 harbor seals, rounded up to 247) could be within estimated harassment zones.

Harbor seals often appear curious about onshore activities and may approach closely. The mouth of Ship Creek, where harbor seals linger, is about 2,500 m from the southern end of the NES1 and is therefore outside of the Level A harassment zones calculated for harbor seals (Table 9). However, given the potential difficulty of tracking individual harbor seals along the face of the NES1 site and their consistent low-level use of the POA area, NMFS anticipates the potential for some take by Level A harassment for harbor seals. For the SFD project, NMFS authorized 8.6 percent of estimated harbor seal takes as potential Level A harassment based on the proportion of previous harbor seal sightings within the estimated Level A harassment zones (86 FR 50057, September 7, 2021), but the NES1 Project is more distant from Ship Creek than SFD. NMFS therefore anticipates that a smaller proportion of takes by Level A harassment may occur during the NES1 project, and proposes to reduce this percentage to 5 percent. Therefore, NMFS proposes to authorize 13 harbor seal takes (5 percent of 247 exposures) by Level A harassment and 234 takes (247 potential exposures minus 13) by Level B harassment, for a total of 247 takes.

Beluga Whale

For the POA's PCT and SFD projects, NMFS used a sighting rate methodology to calculate potential exposure (equated to take) of CIBWs to sound levels above harassment criteria produced by the POA's construction activities (85 FR 19294, April 6, 2020; 86 FR 50057, September 7, 2021, respectively). For the PCT project, NMFS used data collected during marine mammal observations from 2005 to 2009 (Kendall and Cornick, 2015) and the total number of monthly observation hours during these efforts to derive hourly sighting rates of CIBWs per month of observation (April through November) (85 FR 19294, April 6, 2020). For the SFD project, observation data from 2020 PCT construction were also incorporated into the analysis (86 FR 50057, September 7, 2021; 61N Environmental, 2021).

The marine mammal monitoring programs for the PCT and SFD projects produced a unique and comprehensive data set of CIBW locations and movements (table 10; 61N Environmental, 2021, 2022a, 2022b; Easley-Appleyard and Leonard, 2022) that is the most current data set available for Knik Arm. During the PCT and SFD projects, the POA's marine mammal monitoring programs included 11 PSOs working from four elevated, specially designed monitoring stations located along a 9-km stretch of coastline surrounding the POA. The number of days data was collected varied among years and project, with 128 days during PCT Phase 1 in 2020, 74 days during PCT Phase 2 in 2021, and 13 days during SFD in 2022 (see Table 6–7 in the POA's application for additional information regarding CIBW monitoring data). PSOs during these projects used 25-power ''big-eye'' and hand-held binoculars to detect and identify marine mammals, and theodolites to track movements of CIBW groups over time and collect location data while they remained in view.

These POA monitoring programs were supplemented in 2021 with a NMFS-funded visual marine mammal monitoring project that collected data during non-pile driving days during PCT Phase 2 (table 10; Easley-Appleyard and Leonard, 2022). NMFS replicated the POA monitoring efforts, as feasible, including use of 2 of the POA's monitoring platforms, equipment (Big Eye binoculars, theodolite, 7x50 reticle binoculars), data collection software, monitoring and data collection protocol, and observers; however, the NMFS-funded program utilized only 4 PSOs and 2 observation stations along with shorter (4- to 8-hour) observation periods compared to PCT or SFD data collection, which included 11 PSOs, 4 observation stations, and most observation days lasting close to 10 hours. Despite the differences in effort, the NMFS dataset fills in gaps during the 2021 season when CIBW presence began to increase from low presence in July and is thus valuable in this analysis. NMFS' PSO's monitored for 231.6 hours on 47 non-consecutive days in July, August, September, and October.

Distances from CIBW sightings to the project site from the POA and NMFS-funded monitoring programs ranged from less than 10 m up to nearly 15 km during these monitoring programs. These robust marine mammal monitoring programs in place from 2020 through 2022 located, identified, and tracked CIBWs at greater distances from the proposed project site than previous monitoring programs (*i.e.,* Kendall and Cornick, 2015), and has contributed to a better understanding of CIBW movements in upper Cook Inlet (*e.g.,* Easley-Appleyard and Leonard, 2022).

Given the evolution of the best available data of CIBW presence in upper Cook Inlet, particularly regarding the distances at which CIBWs were being observed and documented (which increased during the PCT and SFD compared to earlier monitoring efforts), the POA proposes, and NMFS concurs, that the original sighting rate methodology used for the PCT and SFD projects is no longer the best approach for calculating potential take of CIBWs for the NES1 project. The recent and comprehensive data set of CIBW locations and movements from the PCT and SFD projects (61N Environmental, 2021, 2022a, 2022b; Easley-Appleyard and Leonard, 2022) provides the opportunity for refinement of the previously used sighting rate methodology with updated data. Data for 2020, 2021, and 2022 were selected for the updated sighting rate analysis for the NES1 proposed project because they are the most current data available and are therefore most likely to accurately represent future CIBW occurrence at the proposed project site, which may be affected by CIBW population size, CIBW movement patterns through Knik Arm, environmental change (including climate change), differences in salmon and other prey abundance among years, and other factors (table 10). The data from 2005 to 2009 (Kendall and Cornick, 2015), which was used by NMFS for sighting rate analyses for the PCT and SFD IHAs, were not included in this analysis due to the changes in observation programs and age of the data collected. Monitoring data from the 2016 TPP (Cornick and Seagars, 2016) were also not included in the analysis because of limited hours observed, limited seasonal coverage, and differences in the observation programs.

TABLE 10—MARINE MAMMAL MONITORING DATA USED FOR CIBW SIGHTING RATE CALCULATIONS

Year	Monitoring type and data source	Number of CIBW group fixes	Number of CIBW groups	Number of CIBWs
2020	PCT: POA Construction Monitoring 61N Environmental, 2021	2,653	245	987
2021	PCT: NMFS Monitoring Easley-Appleyard and Leonard, 2022	694	[1]109	575
2021	PCT: POA Construction Monitoring 61N Environmental, 2021, 2022a	1,339	132	517
2022	SFD: POA Construction Monitoring 61N Environmental, 2022b	151	9	41

[1] This number differs slightly from Table 6–8 in the POA's application due to our removal of a few duplicate data points in the NMFS data set.

The sighting rate methodology used for the PCT (85 FR 19294, April 6, 2020) and SFD (86 FR 50057, September 7, 2021) projects used observations of CIBWs recorded in Knik Arm, regardless of observation distance to the POA, to produce a single monthly sighting rate that was then used to calculate potential CIBW take for all activities, regardless of the size of the ensonified areas for the project activities (*i.e.,* take was calculated solely based on the monthly sighting rates and the estimated hours of proposed activities, and did not consider the estimated sizes of the ensonified areas). This method may have overestimated potential CIBW takes when harassment zones were small because distant CIBWs would have been included in the sighting rate. This method also resulted in takes estimates that were identical for installation and removal of all pile sizes, regardless of pile driving method used (*e.g.,* vibratory, impact) or implementation of attenuation systems, since the calculation did not consider the size of the ensonified areas.

NMFS and the POA collaboratively developed a new sighting rate methodology for the NES1 project that incorporates a spatial component for CIBW observations, which would allow for more accurate estimation of potential take of CIBWs for this project. NMFS proposes to use this approach to estimate potential takes of CIBW for authorization. During the POA's and NMFS' marine mammal monitoring programs for the PCT and SFD projects, PSOs had an increased ability to detect, identify, and track CIBWs groups at greater distances from the project work site when compared with previous years because of the POA's expanded monitoring program as described above. This meant that observations of CIBWs in the 2020–2022 dataset (table 10) include sightings of individuals at distances far outside the ensonified areas estimated for the NES1 project (Table 9). Therefore, it would not be appropriate to group all CIBW observations from these datasets into a single sighting rate as was done for the PCT and SFD projects. Rather, we propose that CIBW observations should be considered in relation to their distance to the NES1 project site when determining appropriate sighting rates to use when estimating take for this project. This would help to ensure that the sighting rates used to estimate take are representative of CIBW presence in the proposed ensonified areas.

To incorporate a spatial component into the sighting rate methodology, the POA calculated each CIBW group's closest point of approach (CPOA) relative to the NES1 proposed project site. The 2020–2022 marine mammal monitoring programs (table 10) enabled the collection, in many cases, of multiple locations of CIBW groups as they transited through Knik Arm, which allowed for track lines to be interpolated for many groups. The POA used these track lines, or single recorded locations in instances where only one sighting location was available, to calculate each group's CPOA. CPOAs were calculated in ArcGIS software using the GPS coordinates provided for documented sightings of each group (for details on data collection methods, see 61N Environmental, 2021, 2022a, 2022b; Easley-Appleyard and Leonard, 2022) and the NES1 location midpoint, centered on the proposed project site. A CIBW group was defined as a sighting of one or more CIBWs as determined during data collection. The most distant CPOA location to NES1 was 11,057 m and the closest CPOA location was 15 m.

The cumulative density distribution of CPOA values represents the percentage of CIBW observations that were within various distances to the NES1 action site (Figure 2). This distribution shows how CIBW observations differed with distances to the NES1 site and was used to infer appropriate distances within which to estimate spatially-derived CIBW sighting rates (Figure 2). The POA implemented a piecewise regression model that detected breakpoints (*i.e.,* points within the CPOA data at which statistical properties of the sequence of observational distances changed) in the cumulative density distribution of the CPOA locations, which they proposed to represent spatially-based sighting rate bins for use in calculating CIBW sighting rates. The POA used the ''Segmented'' package (Muggeo, 2020) in the R Statistical Software Package (R Core Team, 2022) to determine statistically significant breakpoints in the linear distances of the CIBW data using this regression method (see Section 6.5.5.3 of the POA's application for more details regarding this statistical analysis). This analysis identified breakpoints in the CPOA locations at 74, 1,651, 2,808, and 7,369 m (Figure 2).

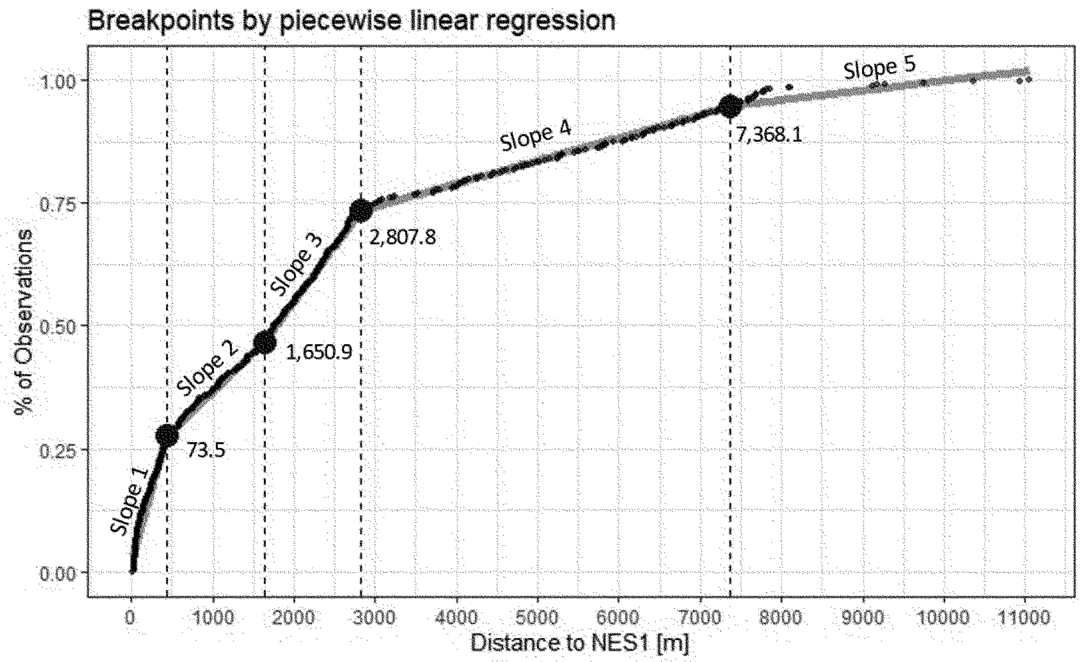

Figure 2 -- Percent of CIBW CPOA Observations in Relation to Distance from the NES1 Project Site and Associated Breakpoints Determined by Piecewise Linear Regression

Piecewise regression is a common tool for modeling ecological thresholds (Lopez *et al.,* 2020; Whitehead *et al.,* 2016; Atwood *et al.,* 2016). In a similar scenario to the one outlined above, Mayette *et al.* (2022) used piecewise regression methods to model the distances between two individual CIBWs in a group in a nearshore and a far shore environment. For the POA's analysis, the breakpoints (*i.e.,* 74, 1,651, 2,808, and 7,369 m) detect a change in the frequency of CIBW groups sighted and the slope of the line between two points indicates the magnitude of change. A greater positive slope indicates a greater accumulation of sightings over the linear distance (x-axis) between the defining breakpoints, whereas a more level slope (*i.e.,* closer to zero) indicates a lower accumulation of sightings over that linear distance (x-axis) between those defining breakpoints (Figure 2; see Table 6–8 in the POA's application for the slope estimates for the empirical cumulative distribution function).

The breakpoints identified by the piecewise regression analysis are in agreement with what is known about CIBW behavior in Knik Arm based on recent monitoring efforts (61N Environmental, 2021, 2022a, 2022b; Easley-Appleyard and Leonard, 2022). Observation location data collected during POA monitoring programs indicate that CIBWs were consistently found in higher numbers in the nearshore areas, along both shorelines, and were found in lower numbers in the center of the Arm. Tracklines of CIBW group movements collected from 2020 to 2022 show that CIBWs displayed a variety of movement patterns that included swimming close to shore past the POA on the east side of Knik Arm (defined by breakpoint 1 at 74 m), with fewer CIBWs swimming in the center of Knik Arm (breakpoints 1 to 2, at 74 to 1,651 m). CIBWs commonly swam past the POA close to shore on the west side of Knik Arm, with no CIBWs able to swim farther from the POA in that area than the far shore (breakpoints 2 to 3, at 1,651 to 2,808 m). Behaviors and locations beyond breakpoint 4 (7,369 m) include swimming past the mouth of Knik Arm between the Susitna River area and Turnagain Arm; milling at the mouth of Knik Arm but not entering the Arm; and milling to the northwest of the POA without exiting Knik Arm. The shallowness of slope 5, at distances greater than 7,369 m, could be due to detection falloff from a proximity (distance) bias, which would occur when PSOs are less likely to detect CIBW groups that are farther away than groups that are closer.

The POA, in collaboration with NMFS, used the distances detected by the breakpoint analysis to define five sighting rate distance bins for CIBWs in the NES1 project area. Each breakpoint (74, 1,651, 2,808, and 7,369 m, and the complete data set of observations [≤ 7,369 m]) was rounded up to the nearest meter and considered the outermost limit of each sighting rate bin, resulting in five identified bins (table 11). All CIBW observations less than each bin's breakpoint distance were used to calculated that bin's respective monthly sighting rates (*e.g.,* all sightings from 0 to 74 m are included in the sighting rates calculated for bin number 1, all sightings from 0 to 1,651 m are included in the sighting rates calculated for bin number 2, and so on). NES1 demolition is anticipated to take place from April through November 2024, therefore monthly sighting rates were only derived for these months (table 11).

TABLE 11—CIBW MONTHLY SIGHTING RATES FOR DIFFERENT SPATIALLY-BASED BIN SIZES

Bin No.	Distance (m)	CIBW/hour [1]							
		April	May	June	July	August	September	October	November
1	≤ 74	0.09	0.06	0.10	0.04	0.83	0.62	0.51	0.11
2	≤ 1,651	0.25	0.14	0.13	0.06	1.43	1.30	1.15	0.70
3	≤ 2,808	0.36	0.22	0.21	0.07	2.08	1.90	2.04	0.73
4	≤ 7,369	0.67	0.33	0.29	0.13	2.25	2.19	2.42	0.73
5	> 7,369	0.71	0.39	0.30	0.13	2.29	2.23	2.56	0.73

[1] Observation hours have been totaled from the PCT 2020 and 2021 programs, the NMFS 2021 data collection effort, and the SFD 2022 program (61N Environmental 2021, 2022a, 2022b; Easley-Appleyard and Leonard, 2022).

Potential exposures (equated with takes) of CIBWs were calculated by multiplying the total number of vibratory installation or removal hours per month for each sized/shaped pile based on the anticipated construction schedule (table 2) with the corresponding sighting rate month and sighting rate distance bin (table 12). For example, the Level B harassment isopleth distance for the vibratory installation of 24-inch (61-cm) piles is 2,247 m, which falls within bin number 3 (table 11). Therefore, take for this activity is calculated by multiplying the total number of hours estimated each month to install 24-inch piles via a vibratory hammer by the monthly CIBW sighting rates calculated for bin number 3 (table 12). The resulting estimated CIBW exposures were totaled for all activities in each month (table 13).

In their calculation of CIBW take, the POA assumed that only 24-inch (61-cm) template piles would be installed (rather than 36-inch, 91-cm) and removed during the project due to the vibratory removal of 24-inch piles having the largest isopleth. If 36-inch (61-cm) piles are used for temporary stability template piles, it would be assumed that the potential impacts of this alternate construction scenario and method on marine mammals are fungible (*i.e.,* that potential impacts of installation and removal of 36-inch (91-cm) steel pipe piles would be similar to the potential impacts of installation and removal of 24-inch (61-cm) steel pipe piles). Using the monthly activity estimates in hours (Table 2) and monthly calculated sighting rates (CIBWs/hour) for the spatially derived distance bins (table 12), the POA estimates that there could be up to 122 (121.1 rounded up to 122) instances of CIBW take where during the NES1 project (table 13).

TABLE 12—ALLOCATION OF EACH LEVEL B HARASSMENT ISOPLETH TO A SIGHTING RATE BIN AND CIBW MONTHLY SIGHTING RATES FOR DIFFERENT PILE SIZES AND HAMMER TYPES

	Level B harassment isopleth distance (m)	Sighting rate bin number and distance	CIBWs/hour							
			April	May	June	July	August	September	October	November
24-inch Vibratory Installation	2,247	3 (2,808 m)	0.36	0.22	0.21	0.07	2.08	1.90	2.04	0.73
24-inch Vibratory Removal	5,968	4 (7,369 m)	0.67	0.33	0.29	0.13	2.25	2.19	2.42	0.73
36-inch Vibratory Installation	4,514	4 (7,369 m)	0.67	0.33	0.29	0.13	2.25	2.19	2.42	0.73
36-inch Vibratory Removal	1,700	3 (2,808 m)	0.36	0.22	0.21	0.07	2.08	1.90	2.04	0.73
Sheet Pile Vibratory Removal	1,954	3 (2,808 m)	0.36	0.22	0.21	0.07	2.08	1.90	2.04	0.73
Observation Hours/Month [1]:			87.9	615.1	571.6	246.9	224.5	326.2	109.5	132.0

[1] Observation hours have been totaled from the PCT 2020 and 2021 programs, the NMFS 2021 data collection effort, and the SFD 2022 program (61N Environmental, 2021, 2022a, 2022b; Easley-Appleyard and Leonard, 2022).

For the PCT (85 FR 19294, April 6, 2020) and SFD (86 FR 50057, September 7, 2021) projects, NMFS accounted for the implementation of mitigation measures (*e.g.,* shutdown procedures implemented when CIBWs entered or approached the estimated Level B harassment zone) by applying an adjustment factor to CIBW take estimates. This was based on the assumption that some Level B harassment takes would likely be avoided based on required shutdowns for CIBWs at the Level B harassment zones (see the Proposed Mitigation section for more information). For the PCT project, NMFS compared the number of realized takes at the POA to the number of authorized takes for previous projects from 2008 to 2017 and found the percentage of realized takes ranged from 12 to 59 percent with an average of 36 percent (85 FR 19294, April 6, 2020). NMFS then applied the highest percentage of previous realized takes (59 percent during the 2009–2010 season) to ensure potential takes of CIBWs were fully evaluated. In doing so, NMFS assumed that approximately 59 percent of the takes calculated would be realized during PCT and SFD construction (85 FR 19294, April 6, 2020; 86 FR 50057, September 7, 2021) and that 41 percent of the calculated CIBW Level B harassment takes would be avoided by successful implementation of required mitigation measures.

The POA calculated the adjustment for successful implementation of mitigation measures for NES1 using the percentage of realized takes for the PCT project (see Table 6–12 in the POA's application). The recent data from PCT Phase 1 and PCT Phase 2 most accurately reflect the current marine mammal monitoring program, the current program's effectiveness, and CIBW occurrence in the proposed project area. Between the two phases of the PCT project, 90 total Level B harassment takes were authorized and 53 were potentially realized (*i.e.,* number of CIBWs observed within estimated Level B harassment zones), equating to an overall percentage of 59 percent. The SFD Project, during which only 7 percent of authorized take was potentially realized, represents installation of only 12 piles during a limited time period and does not represent the much higher number of piles and longer construction season anticipated for NES1.2

NMFS proposes that the 59-percent adjustment accurately accounts for the efficacy of the POA's marine mammal monitoring program and required shutdown protocols. NMFS therefore assumes that approximately 59 percent of the takes calculated for NES1 may actually be realized. This adjusts the potential takes by Level B harassment of CIBWs proposed for authorization from 122 to 72 (table 13). Take by Level A harassment is not anticipated or proposed to be authorized because the POA will be required to shutdown activities when CIBWs approach and or enter the Level B harassment zone (see the Proposed Mitigation section for more information).

TABLE 13—POTENTIAL MONTHLY CIBW LEVEL B HARASSMENT EXPOSURES

	April	May	June	July	August	September	October	November	Total
24-inch Vibratory Installation and Removal	2.5	3.0	1.7	0.6	12.5	6.9	3.9	0.2	31.3
Sheet Pile Removal	3.6	9.9	12.5	4.4	27.0	22.8	8.1	1.5	89.8
Total Estimated Level B Harassment Exposures for All Activities (Rounded):									121.1
Total Estimated Level B Harassment Exposures with 59% Correction Factor (Rounded):									71.5 (72)

In summary, the total amount of Level A harassment and Level B harassment proposed to be authorized for each marine mammal stock is presented in table 14.

TABLE 14—AMOUNT OF PROPOSED TAKE AS A PERCENTAGE OF STOCK ABUNDANCE, BY STOCK AND HARASSMENT TYPE

Species	Proposed take			Stock	Percent of stock
	Level A	Level B	Total		
Gray whale	0	6	6	Eastern North Pacific	[1] 0.02
Humpback whale	0	4	4	Hawai'i	[1] 0.04
				Mexico-North Pacific	[2] UNK
Beluga whale	0	72	72	Cook Inlet	21.75
Killer whale	0	6	6	Eastern North Pacific Alaska Resident	[1] 0.31
				Eastern North Pacific Gulf of Alaska, Aleutian Islands and Bering Sea Transient.	1.02[1]
Harbor porpoise	1	17	18	Gulf of Alaska	0.06
Steller sea lion	0	9	9	Western	0.02
Harbor seals	13	234	247	Cook Inlet/Shelikof Strait	0.87

[1] NMFS conservatively assumes that all takes occur to each stock.
[2] NMFS does not have an official abundance estimate for this stock and the minimum population estimate is considered to be unknown (Young *et al.,* 2023).

Proposed Mitigation

In order to issue an IHA under section 101(a)(5)(D) of the MMPA, NMFS must set forth the permissible methods of taking pursuant to the activity, and other means of effecting the least practicable impact on the species or stock and its habitat, paying particular attention to rookeries, mating grounds, and areas of similar significance, and on the availability of the species or stock for taking for certain subsistence uses (latter not applicable for this action). NMFS regulations require applicants for incidental take authorizations to include information about the availability and feasibility (economic and technological) of equipment, methods, and manner of conducting the activity or other means of effecting the least practicable adverse impact upon the affected species or stocks, and their habitat (50 CFR 216.104(a)(11)).

In evaluating how mitigation may or may not be appropriate to ensure the least practicable adverse impact on species or stocks and their habitat, as well as subsistence uses where applicable, NMFS considers two primary factors:

(1) The manner in which, and the degree to which, the successful implementation of the measure(s) is expected to reduce impacts to marine mammals, marine mammal species or stocks, and their habitat. This considers the nature of the potential adverse impact being mitigated (likelihood, scope, range). It further considers the likelihood that the measure will be effective if implemented (probability of accomplishing the mitigating result if implemented as planned), the likelihood of effective implementation (probability implemented as planned), and;

(2) The practicability of the measures for applicant implementation, which may consider such things as cost, and impact on operations.

The POA presented mitigation measures in Section 11 of their application that were modeled after the requirements included in the IHAs issued for Phase 1 and Phase 2 PCT construction (85 FR 19294, April 6, 2020) and for SFD construction (86 FR 50057, September 7, 2021), which were designed to minimize the total number, intensity, and duration of harassment events for CIBWs and other marine mammal species during those projects (61N Environmental, 2021, 2022a, 2022b). NMFS concurs that these proposed measures reduce the potential for CIBWs, and other marine mammals, to be adversely impacted by the proposed activity.

The POA must employ the following mitigation measures:

- Ensure that construction supervisors and crews, the monitoring team and relevant POA staff are trained prior to the start of all pile driving, so that responsibilities, communication procedures, monitoring protocols, and operational procedures are clearly understood. New personnel joining during the project must be trained prior to commencing work;
- Employ PSOs and establish monitoring locations as described in Section 5 of the IHA and the POA's Marine Mammal Monitoring and Mitigation Plan (see Appendix B of the POA's application). The POA must monitor the project area to the maximum extent possible based on the required number of PSOs, required monitoring locations, and environmental conditions;
- Monitoring must take place from 30 minutes prior to initiation of pile driving (*i.e.,* pre-clearance monitoring) through 30 minutes post-completion of pile driving;
- Pre-start clearance monitoring must be conducted during periods of visibility sufficient for the lead PSO to determine that the shutdown zones indicated in table 15 are clear of marine mammals. Pile driving may commence following 30 minutes of observation when the determination is made that the shutdown zones are clear of marine mammals or when the mitigation measures proposed specifically for CIBWs (below) are satisfied;
- For all construction activities, shutdown zones must be established following table 15. The purpose of a shutdown zone is generally to define an area within which shutdown of activity would occur upon sighting of a marine mammal (or in anticipation of an animal entering the defined area). In addition to the shutdown zones specified in table 15 and the minimum shutdown zone of 10-m described above, requirements included in NMFS' proposed IHA, the POA plans to implement a minimum 100-m shutdown zone around the active NES1 project work site, including around activities other than pile installation or removal that NMFS has determined do not present a reasonable potential to cause take of marine mammals. Shutdown zones for pile installation and removal would vary based on the type of construction activity and by marine mammal hearing group (table 15). Here, shutdown zones are larger than or equal to the calculated Level A harassment isopleths shown in table 9 for species other than CIBW and are equal to the estimated Level B harassment isopleths for CIBWs;

TABLE 15—PROPOSED SHUTDOWN ZONES DURING PROJECT ACTIVITIES

Activity	Pile type/size	Shutdown zone (m)				PW	OW
		LF cetaceans	Non-CIBW MF cetaceans	CIBWs	HF cetaceans		
Impact Removal	Sheet pile	160	10	900	190	90	10
Vibratory Installation.	24-inch (61-cm)	20	10	2,300	20	10	10
	36-inch (91-cm)	30	10	4,600	40	20	10
Vibratory Removal	Sheet pile	10	10	2,000	20	10	10
	24-inch (61-cm)	40	10	6,000	60	30	10
	36-inch (91-cm)	20	10	1,700	20	10	10

Notes: cm = centimeter(s), m = meter(s).

- Marine mammals observed anywhere within visual range of the PSO must be tracked relative to construction activities. If a marine mammal is observed entering or within the shutdown zones indicated in table 15, pile driving must be delayed or halted. If pile driving is delayed or halted due to the presence of a marine mammal, the activity may not commence or resume until either the animal has voluntarily exited and been visually confirmed beyond the shutdown zone (table 15, or 15 minutes (non-CIBWs) or 30 minutes (CIBWs) have passed without re-detection of the animal;
- The POA must use soft start techniques when impact pile driving. Soft start requires contractors to provide an initial set of three strikes at reduced energy, followed by a 30-second waiting period, then two subsequent reduced energy strike sets. A soft start must be implemented at the start of each day's impact pile driving and at any time following cessation of impact pile driving for a period of 30 minutes or longer. PSOs shall begin observing for marine mammals 30 minutes before "soft start" or in-water pile installation or removal begins;
- Pile driving activity must be halted upon observation of either a species for which incidental take is not authorized or a species for which incidental take has been authorized but the authorized number of takes has been met, entering or within the harassment zone; and
- The POA must avoid direct physical interaction with marine mammals during construction activities. If a marine mammal comes within 10 m of such activity, operations shall cease. Should a marine mammal come within 10 m of a vessel in transit, the boat operator will reduce vessel speed to the minimum level required to maintain steerage and safe working conditions. If human safety is at risk, the in-water activity will be allowed to continue until it is safe to stop.

The following additional mitigation measures are proposed by NMFS for CIBWs:

- The POA must make all practicable efforts to complete construction activities between April and July, when CIBWs are typically found in lower numbers near the proposed site;
- Prior to the onset of pile driving, should a CIBW be observed approaching the estimated Level B harassment zone (Table 9) (*i.e.* the CIBWs shutdown zone column in Table 15), pile driving must not commence until the whale(s) moves

at least 100 m past the estimated Level B harassment zone and on a path away from the zone, or the whale has not been re-sighted within 30 minutes;

• If pile installation or removal has commenced, and a CIBW(s) is observed within or likely to enter the estimated Level B harassment zone, pile installation or removal must shut down and not re-commence until the whale has traveled at least 100 m beyond the Level B harassment zone and is on a path away from such zone or until no CIBW has been observed in the Level B harassment zone for 30 minutes; and

• If during installation and removal of piles, PSOs can no longer effectively monitor the entirety of the CIBW Level B harassment zone due to environmental conditions (*e.g.,* fog, rain, wind), pile driving may continue only until the current segment of the pile is driven; no additional sections of pile or additional piles may be driven until conditions improve such that the Level B harassment zone can be effectively monitored. If the Level B harassment zone cannot be monitored for more than 15 minutes, the entire Level B harassment zone will be cleared again for 30 minutes prior to pile driving.

In addition to these additional mitigation measures being proposed by NMFS, NMFS requested that the POA restrict all pile driving and removal work to April to July, when CIBWs are typically found in lower numbers. However, given the safety and environmental concerns of collapse of the Northern Extension once removal work commences, required sequencing of pile installation and removal and fill removal, and uncertainties and adaptive nature of the work, the POA stated that it cannot commit to restricting pile driving and removal to April to July. Instead, as required in the proposed mitigation, NMFS would require the POA to complete as much work as is practicable in April to July to reduce the amount of pile driving and removal activities in August through November.

For previous IHAs issued to the POA (PCT: 85 FR 19294, April 6, 2020; SFD: 86 FR 50057, September 7, 2021), the use of a bubble curtain to reduce noise has been required as a mitigation measure for certain pile driving scenarios. The POA did not propose to use a bubble curtain system during the NES1 project, stating that it is not a practicable mitigation measure for this demolition project. NMFS concurs with this determination. Practicability concerns include the following:

• NES1 construction activities includes installation of round, temporary, stability template piles to shore up the filled NES1 structure while fill material and sheet piles are removed. Stability template piles that would be required for demolition of the sheet pile structure are located in proximity of the sheet piles. A bubble curtain would not physically fit between the sheet piles and the template piles;

• Bubble curtains could not be installed around the sheet piles as they are removed because the structure consists of sheet piles that are connected to one another and used to support fill-material. It would not be possible to place a bubble curtain system along the sheet pile face for similar reasons, including lack of space for the bubble curtain and the structures and equipment that would be needed to install and operate it, and the high likelihood that it could not function or be retrieved; and

• NES1 is a failed structure, and has been deemed ''globally unstable'' and poses significant risk for continued deterioration and structural collapse. If the existing structure were to collapse during deconstruction and sheet pile removal, there is risk of a significant release of impounded fill material into CIBW habitat, the POA's vessel operating and mooring areas, and the USACE Anchorage Harbor Project. Due to the stability risk of the existing impounded material, it is expected that construction and demolition means and methods would be highly adaptive once actual field work commences, and use of a bubble curtain with deconstruction would limit operations in the field and create significant health and safety issues.

The POA also has efficacy concerns about requiring a bubble curtain for NES1 construction activities. Adding a requirement for a bubble curtain may hinder production, due to the time required to install and remove the bubble curtain itself. This has the potential to drive the in-water construction schedule further into the late summer months, which are known for higher CIBW abundance in lower Knik Arm, thus lengthening the duration of potential interactions between CIBW and in-water works. Therefore, NMFS is concerned that use of a bubble curtain may not be an effective measure, given the potential that bubble curtain use could ultimately result in increased impacts to CIBW, in addition to the aforementioned practicability issues.

Based on our evaluation of the applicant's proposed measures, as well as other measures considered by NMFS, NMFS has preliminarily determined that the proposed mitigation measures provide the means of effecting the least practicable impact on the affected species or stocks and their habitat, paying particular attention to rookeries, mating grounds, and areas of similar significance.

Proposed Monitoring and Reporting

In order to issue an IHA for an activity, section 101(a)(5)(D) of the MMPA states that NMFS must set forth requirements pertaining to the monitoring and reporting of such taking. The MMPA implementing regulations at 50 CFR 216.104(a)(13) indicate that requests for authorizations must include the suggested means of accomplishing the necessary monitoring and reporting that will result in increased knowledge of the species and of the level of taking or impacts on populations of marine mammals that are expected to be present while conducting the activities. Effective reporting is critical both to compliance as well as ensuring that the most value is obtained from the required monitoring.

Monitoring and reporting requirements prescribed by NMFS should contribute to improved understanding of one or more of the following:

• Occurrence of marine mammal species or stocks in the area in which take is anticipated (*e.g.,* presence, abundance, distribution, density);

• Nature, scope, or context of likely marine mammal exposure to potential stressors/impacts (individual or cumulative, acute or chronic), through better understanding of: (1) action or environment (*e.g.,* source characterization, propagation, ambient noise); (2) affected species (*e.g.,* life history, dive patterns); (3) co-occurrence of marine mammal species with the activity; or (4) biological or behavioral context of exposure (*e.g.,* age, calving or feeding areas);

• Individual marine mammal responses (behavioral or physiological) to acoustic stressors (acute, chronic, or cumulative), other stressors, or cumulative impacts from multiple stressors;

• How anticipated responses to stressors impact either: (1) long-term fitness and survival of individual marine mammals; or (2) populations, species, or stocks;

• Effects on marine mammal habitat (*e.g.,* marine mammal prey species, acoustic habitat, or other important physical components of marine mammal habitat); and,

• Mitigation and monitoring effectiveness.

The POA would implement a marine mammal monitoring and mitigation strategy intended to avoid and minimize impacts to marine mammals (see Appendix B of the POA's application for their Marine Mammal Monitoring and Mitigation Plan). Marine mammal monitoring would be conducted at all times when in-water pile installation and removal is taking place. Additionally, PSOs would be on-site monitoring for marine mammals during in-water cutting of sheet piles with shears or an ultrathermic torch.

The marine mammal monitoring and mitigation program that is planned for NES1 construction would be modeled after the stipulations outlined in the IHAs for Phase 1 and Phase 2 PCT construction (85 FR 19294, April 6, 2020) and the IHA for SFD construction (86 FR 50057, September 7, 2021).

Visual Monitoring

Monitoring must be conducted by qualified, NMFS-approved PSOs, in accordance with the following:

• PSOs must be independent of the activity contractor (*e.g.,* employed by a subcontractor) and have no other assigned tasks during monitoring periods. At least one PSO must have prior experience performing the duties of a PSO during construction activity pursuant to a NMFS-issued IHA or Letter of Concurrence. Other PSOs may substitute other relevant experience, education (degree in biological science or related field), or training for prior experience performing the duties of a PSO. PSOs must be approved by NMFS prior to beginning any activity subject to this IHA;

• The POA must employ PSO stations at a minimum of two locations from which PSOs can effectively monitor the shutdown zones (Table 15). Concerns about the stability of the NES1 project area preclude determination of the exact number and locations of PSO stations until the Construction Contractor develops their Construction Work Plan. PSO stations must be positioned at the best practical vantage points that are determined to be safe. Likely locations include the Anchorage Public Boat Dock at Ship Creek to the south of the proposed project site, and a location to the north of the project site, such as the northern end of POA property near Cairn Point (see North Extension area on Figure 12–1 in the POA's application) or at Port MacKenzie across Knik Arm (see Figure 12–1 in the POA's application for potential locations of PSO stations). A location near the construction activity may not be possible given the risk of structural collapse as outlined in the POA's IHA application. Placing a PSO on the northernmost portion of Terminal 3 would also be considered if deemed safe. Areas near Cairn Point or Port MacKenzie have safety, security, and logistical issues, which would need to be considered. Cairn Point proper is located on military land and has bear presence, and restricted access does not allow for the location of an observation station at this site. Tidelands along Cairn Point are accessible only during low tide conditions and have inherent safety concerns of being trapped by rising tides. Port MacKenzie is a secure port that is relatively remote, creating safety, logistical, and physical staffing limitations due to lack of nearby lodging and other facilities. The roadway travel time between port sites is approximately 2–3 hours. An adaptive management measure is proposed for a monitoring location north of the proposed project site, once the Construction Contractor has been selected and more detailed discussions can occur. Temporary staffing of a northerly monitoring station during peak marine mammal presence time periods and/or when shutdown zones are large would be considered. At least one PSO station must be able to fully observe the shutdown zones (Table 15);

• PSOs stations must be elevated platforms constructed on top of shipping containers or a similar base that is at least 8′ 6″ high (*i.e.,* the standard height of a shipping container) that can support up to three PSOs and their equipment. The platforms must be stable enough to support use of a theodolite and must be located to optimize the PSO's ability to observe marine mammals and the harassment zones;

• Each PSO station must have at least two PSOs on watch at any given time; one PSO must be observing, one PSO would be recording data (and observing when there are no data to record). Teams of three PSOs would include one PSO who would be observing, one PSO who would be recording data (and observing when there are no data to record), and one PSO who would be resting. In addition, if POA is conducting non-NES1-related in-water work that includes PSOs, the NES1 PSOs must be in real-time contact with those PSOs, and both sets of PSOs must share all information regarding marine mammal sightings with each other;

• A designated lead PSO must always be on site. The lead observer must have prior experience performing the duties of a PSO during in-water construction activities pursuant to a NMFS-issued incidental take authorization or Letter of Concurrence. Each PSO station must also have a designated lead PSO specific to that station and shift. These lead PSOs must have prior experience working as a PSO during in-water construction activities;

• PSOs would use a combination of equipment to perform marine mammal observations and to verify the required monitoring distance from the project site, including 7 by 50 binoculars, 20x/40x tripod mounted binoculars, 25 by 150 ''big eye'' tripod mounted binoculars, and theodolites;

• PSOs must record all observations of marine mammals, regardless of distance from the pile being driven. PSOs shall document any behavioral reactions in concert with distance from piles being driven or removed;

PSOs must have the following additional qualifications:

• Ability to conduct field observations and collect data according to assigned protocols;

• Experience or training in the field identification of marine mammals, including the identification of behaviors;

• Sufficient training, orientation, or experience with the construction operation to provide for personal safety during observations;

• Writing skills sufficient to record required information including but not limited to the number and species of marine mammals observed; dates and times when in-water construction activities were conducted; dates, times, and reason for implementation of mitigation (or why mitigation was not implemented when required); and marine mammal behavior; and

• Ability to communicate orally, by radio or in person, with project personnel to provide real-time information on marine mammals observed in the area as necessary.

Reporting

NMFS would require the POA to submit interim weekly and monthly monitoring reports (that include raw electronic data sheets) during the NES1 construction season. These reports must include a summary of marine mammal species and behavioral observations, construction shutdowns or delays, and construction work completed. They also must include an assessment of the amount of construction remaining to be completed (*i.e.,* the number of estimated hours of work remaining), in addition to the number of CIBWs observed within estimated harassment zones to date.

A draft summary marine mammal monitoring report must be submitted to NMFS within 90 days after the completion of all construction activities, or 60 days prior to a requested date of issuance of any future incidental take authorization for projects at the same location, whichever comes first. The report would include an overall description of work completed, a narrative regarding marine mammal sightings, and associated PSO data sheets. Specifically, the report must include:

• Dates and times (begin and end) of all marine mammal monitoring;

• Construction activities occurring during each daily observation period, including the number and type of piles driven or removed and by what method (*i.e.,* impact or vibratory, the total equipment duration for vibratory installation and removal, and the total number of strikes for each pile during impact driving;

• PSO locations during marine mammal monitoring;

• Environmental conditions during monitoring periods (at beginning and end of PSO shift and whenever conditions change significantly), including Beaufort sea state and any other relevant weather conditions including cloud cover, fog, sun glare, and overall visibility to the horizon, and estimated observable distance;

• Upon observation of a marine mammal, the following information: name of PSO who sighted the animal(s) and PSO location and activity at time of sighting; time of sighting; identification of the animal(s) (*e.g.,* genus/species, lowest possible taxonomic level, or unidentified), PSO confidence in identification, and the composition of the group if there is a mix of species; distance and bearing of each marine mammal observed relative to the pile being driven for each sighting (if pile driving was occurring at time of sighting); estimated number of animals (minimum, maximum, and best estimate); estimated number of animals by cohort (adults, juveniles, neonates, group composition, sex class, *etc.*); animal's closest point of approach and estimated time spent within the harassment zone; group spread and formation (for CIBWs only); description of any marine mammal behavioral observations (*e.g.,* observed behaviors such as feeding or traveling), including an assessment of behavioral responses that may have resulted from the activity (*e.g.,* no response or changes in behavioral state such as ceasing feeding, changing direction, flushing, or breaching);

• Number of marine mammals detected within the harassment zones and shutdown zones, by species;

• Detailed information about any implementation of any mitigation triggered (*e.g.,* shutdowns and delays), a description of specific actions that ensued, and resulting changes in behavior of the animal(s), if any;

If no comments are received from NMFS within 30 days, the draft final report would constitute the final report. If comments are received, a final report addressing NMFS comments must be submitted within 30 days after receipt of comments.

Reporting Injured or Dead Marine Mammals

In the event that personnel involved in the construction activities discover an injured or dead marine mammal, the IHA-holder must immediately cease the specified activities and report the incident to the Office of Protected Resources, NMFS (*PR.ITP.MonitoringReports@noaa.gov*), and to the Alaska Regional Stranding Coordinator as soon as feasible. If the death or injury was clearly caused by the specified activity, the POA must immediately cease the specified activities until NMFS is able to review the circumstances of the incident and determine what, if any, additional measures are appropriate to ensure compliance with the terms of the IHA. The POA must not resume their activities until notified by NMFS. The report must include the following information:

• Time, date, and location (latitude and longitude) of the first discovery (and updated location information if known and applicable);

• Species identification (if known) or description of the animal(s) involved;

• Condition of the animal(s) (including carcass condition if the animal is dead);

• Observed behaviors of the animal(s), if alive;

• If available, photographs or video footage of the animal(s); and

• General circumstances under which the animal was discovered.

Negligible Impact Analysis and Determination

NMFS has defined negligible impact as an impact resulting from the specified activity that cannot be reasonably expected to, and is not reasonably likely to, adversely affect the species or stock through effects on annual rates of recruitment or survival (50 CFR 216.103). A negligible impact finding is based on the lack of likely adverse effects on annual rates of recruitment or survival (*i.e.,* population-level effects). An estimate of the number of takes alone is not enough information on which to base an impact determination. In addition to considering estimates of the number of marine mammals that might be ''taken'' through harassment, NMFS considers other factors, such as the likely nature of any impacts or responses (*e.g.,* intensity, duration), the context of any impacts or responses (*e.g.,* critical reproductive time or location, foraging impacts affecting energetics), as well as effects on habitat, and the likely effectiveness of the mitigation. We also assess the number, intensity, and context of estimated takes by evaluating this information relative to population status. Consistent with the 1989 preamble for NMFS' implementing regulations (54 FR 40338, September 29, 1989), the impacts from other past and ongoing anthropogenic activities are incorporated into this analysis via their impacts on the baseline (*e.g.,* as reflected in the regulatory status of the species, population size and growth rate where known, ongoing sources of human-caused mortality, or ambient noise levels).

To avoid repetition, this introductory discussion of our analysis applies to all the species listed in Table 14, except CIBWs, given that many of the anticipated effects of this project on different marine mammal stocks are expected to be relatively similar in nature. For CIBWs, there are meaningful differences in anticipated individual responses to activities, impact of expected take on the population, or impacts on habitat; therefore, we provide a separate detailed analysis for CIBWs following the analysis for other species for which we propose take authorization.

NMFS has identified key factors which may be employed to assess the level of analysis necessary to conclude whether potential impacts associated with a specified activity should be considered negligible. These include (but are not limited to) the type and magnitude of taking, the amount and importance of the available habitat for the species or stock that is affected, the duration of the anticipated effect to the species or stock, and the status of the species or stock. The potential effects of the specified actions on gray whales, humpback whales, killer whales, harbor porpoises, Steller sea lions, and harbor seals are discussed below. Some of these factors also apply to CIBWs; however, a more detailed analysis for CIBWs is provided in a separate sub-section below.

Pile driving associated with the project, as outlined previously, has the potential to disturb or displace marine mammals. Specifically, the specified activities may result in take, in the form of Level B harassment and, for some species, Level A harassment, from underwater sounds generated by pile driving. Potential takes could occur if marine mammals are present in zones ensonified above the thresholds for Level B harassment or Level A harassment, identified above, while activities are underway.

The POA's proposed activities and associated impacts would occur within a limited, confined area of the stocks' range. The work would occur in the vicinity of the NES1 site and sound from the proposed activities would be blocked by the coastline along Knik Arm along the eastern boundaries of the site, and for those harassment isopleths that extend more than 3,000 m (*i.e.,* the vibratory installation of 36-inch (91-cm) piles and vibratory removal of 24-inch (61-inch) piles), directly across the Arm along the western shoreline (see Figure 6–4 in the POA's application)). The intensity and duration of take by Level A and Level B harassment would be minimized through use of mitigation measures described herein. Further the amount of take proposed to be authorized is small when compared to stock abundance (see Table 14). In addition, NMFS does not anticipate that serious injury or mortality will occur as a result of the POA's planned activity given the nature of the activity, even in the absence of required mitigation.

Exposures to elevated sound levels produced during pile driving may cause behavioral disturbance of some individuals. Behavioral responses of marine mammals to pile driving at the proposed project site are expected to be mild, short term, and temporary. Effects on individuals that are taken by Level B harassment, as enumerated in the Estimated Take section, on the basis of reports in the literature as well as monitoring from other similar activities at the POA and elsewhere, will likely be limited to reactions such as increased swimming speeds, increased surfacing time, or decreased foraging (if such activity were occurring; *e.g.,* Ridgway *et al.,* 1997; Nowacek *et al.,* 2007; Thorson and Reyff, 2006; Kendall and Cornick, 2015; Goldbogen *et al.,* 2013b; Piwetz *et al.,* 2021). Marine mammals within the Level B harassment zones may not show any visual cues they are disturbed by activities or they could become alert, avoid the area, leave the area, or display other mild responses that are not observable such as changes in vocalization patterns or increased haul out time (*e.g.,* Tougaard *et al.,* 2003; Carstensen *et al.,* 2006; Thorson and Reyff, 2006; Parks *et al.,* 2007; Brandt *et al.,* 2011; Graham *et al.,* 2017). However, as described in the Potential Effects of Specified Activities on Marine Mammals and Their Habitat section of this notice, marine mammals, excepting CIBWs, observed within Level A and Level B harassment zones related to recent POA construction activities have not shown any acute observable reactions to pile driving activities that have occurred during the PCT and SFD projects (61N Environmental, 2021, 2022a, 2022b).

Some of the species present in the region will only be present temporarily based on seasonal patterns or during transit between other habitats. These temporarily present species will be exposed to even smaller periods of noise-generating activity, further decreasing the impacts. Most likely, individual animals will simply move away from the sound source and be temporarily displaced from the area. Takes may also occur during important feeding times. The project area though represents a small portion of available foraging habitat and impacts on marine mammal feeding for all species should be minimal.

The activities analyzed here are similar to numerous other construction activities conducted in Alaska (*e.g.,* 86 FR 43190, August 6, 2021; 87 FR 15387, March 18, 2022), including the PCT and SFD projects within Upper Knik Arm (85 FR 19294, April 6, 2020; 86 FR 50057, September 7, 2021, respectively) which have taken place with no known long-term adverse consequences from behavioral harassment. Any potential reactions and behavioral changes are expected to subside quickly when the exposures cease and, therefore, no such long-term adverse consequences should be expected (*e.g.,* Graham *et al.,* 2017). For example, harbor porpoises returned to a construction area between pile-driving events within several days during the construction of offshore wind turbines near Denmark (Carstensen *et al.,* 2006). The intensity of Level B harassment events would be minimized through use of mitigation measures described herein, which were not quantitatively factored into the take estimates. The POA would use PSOs stationed strategically to increase detectability of marine mammals during in-water construction activities, enabling a high rate of success in implementation of shutdowns to avoid or minimize injury for most species. Further, given the absence of any major rookeries and haulouts within the estimated harassment zones, we assume that potential takes by Level B harassment would have an inconsequential short-term effect on individuals and would not result in population-level impacts.

As stated in the mitigation section, the POA will implement shutdown zones that equal or exceed the Level A harassment isopleths shown in Table 9. Take by Level A harassment is proposed for authorization for some species (harbor seals and harbor porpoises) to account for the potential that an animal could enter and remain within the Level A harassment zone for a duration long enough to incur PTS. Any take by Level A harassment is expected to arise from, at most, a small degree of PTS because animals would need to be exposed to higher levels and/or longer duration than are expected to occur here in order to incur any more than a small degree of PTS.

Due to the levels and durations of likely exposure, animals that experience PTS will likely only receive slight PTS, *i.e.,* minor degradation of hearing capabilities within regions of hearing that align most completely with the frequency range of the energy produced by POA's proposed in-water construction activities (*i.e.,* the low-frequency region below 2 kHz), not severe hearing impairment or impairment in the ranges of greatest hearing sensitivity. If hearing impairment does occur, it is most likely that the affected animal will lose a few dBs in its hearing sensitivity, which in most cases is not likely to meaningfully affect its ability to forage and communicate with conspecifics. There are no data to suggest that a single instance in which an animal accrues PTS (or TTS) and is subject to behavioral disturbance would result in impacts to reproduction or survival. If PTS were to occur, it would be at a lower level likely to accrue to a relatively small portion of the population by being a stationary activity in one particular location. Additionally, and as noted previously, some subset of the individuals that are behaviorally harassed could also simultaneously incur some small degree of TTS for a short duration of time. Because of the small degree anticipated, though, any PTS or TTS potentially incurred here is not expected to adversely impact individual fitness, let alone annual rates of recruitment or survival.

Theoretically, repeated, sequential exposure to pile driving noise over a long duration could result in more severe impacts to individuals that could affect a population (via sustained or repeated disruption of important behaviors such as feeding, resting, traveling, and socializing; Southall *et al.,* 2007). Alternatively, marine mammals exposed to repetitious construction sounds may become habituated, desensitized, or tolerant after initial exposure to these sounds (reviewed by Richardson *et al.,* 1995; Southall *et al.,* 2007). Given that marine mammals still frequent and use Knik Arm despite being exposed to pile driving activities across many years, these severe population level of impacts are not anticipated. The absence of any pinniped haulouts or other known non-CIBW home-ranges in the proposed action area further decreases the likelihood of severe population level impacts.

The NES1 project is also not expected to have significant adverse effects on any marine mammal habitat. The project activities would occur within the same footprint as existing marine infrastructure, and when construction is complete, subtidal and intertidal habitats previously lost at the project site would be restored. Impacts to the immediate substrate are anticipated, but these would be limited to minor, temporary suspension of sediments, which could impact water quality and visibility for a short amount of time but which would not be expected to have any effects on individual marine mammals. While the area is generally not high quality habitat, it is expected to be of higher quality to marine mammals and fish after NES1 construction is complete as the site returns to its natural state and is colonized by marine organisms. Further, there are no known BIAs near the project zone, except for CIBWs, that will be impacted by the POA's planned activities.

Impacts to marine mammal prey species are also expected to be minor and temporary and to have, at most, short-term effects on foraging of individual marine mammals, and likely no effect on the populations of marine mammals as a whole. Overall, the area impacted by the NES1 project is very small compared to the available surrounding habitat, and does not include habitat of particular importance. The most likely impact to prey would be temporary behavioral avoidance of the immediate area. During construction activities, it is expected that some fish and marine mammals would temporarily leave the area of disturbance, thus impacting marine mammals' foraging opportunities in a limited portion of their foraging range. But, because of the relatively small area of the habitat that may be affected, and lack of any habitat of particular importance, the impacts to marine mammal habitat are not expected to cause significant or long-term negative consequences. Further, as described above, additional habitat for marine mammal prey will be available after the completion of the proposed construction activities likely providing additional foraging, migrating, and rearing habitats to fish and foraging habitat to marine mammals.

In summary and as described above, the following factors support our preliminary negligible impact determinations for the affected stocks of gray whales, humpback whales, killer whales, harbor porpoises, Steller sea lions, and harbor seals:

- No takes by mortality or serious injury are anticipated or authorized;
- Any acoustic impacts to marine mammal habitat from pile driving (including to prey sources as well as acoustic habitat, and including resulting behavioral impacts *e.g.,* from masking) are expected to be temporary and minimal;
- Take would not occur in places and/or times where take would be more likely to accrue to impacts on reproduction or survival, such as within ESA-designated or proposed critical habitat, BIAs, or other habitats critical to recruitment or survival (*e.g.,* rookery);
- The project area represents a very small portion of the available foraging area for all potentially impacted marine mammal species;
- Take will only occur within upper Cook Inlet—a limited, confined area of any given stock's home range;
- Monitoring reports from similar work in Knik Arm have documented little to no observable effect on individuals of the same species impacted by the specified activities;
- The required mitigation measures (*i.e.,* soft starts, pre-clearance monitoring, shutdown zones) are expected to be effective in reducing the effects of the specified activity by minimizing the numbers of marine mammals exposed to injurious levels of sound, and by ensuring that any take by Level A harassment is, at most, a small degree of PTS and of a lower degree that would not impact the fitness of any animals; and
- The intensity of anticipated takes by Level B harassment is low for all stocks consisting of, at worst, temporary modifications in behavior, and would not be of a duration or intensity expected to result in impacts on reproduction or survival.

Cook Inlet Beluga Whales. For CIBWs, we further discuss our negligible impact findings in the context of potential impacts to this endangered stock based on our evaluation of the take proposed for authorization (Table 14).

As described in the Recovery Plan for the CIBW (NMFS, 2016b), NMFS determined the following physical or biological features are essential to the conservation of this species: (1) Intertidal and subtidal waters of Cook Inlet with depths less than 9 m mean lower low water and within 8 km of high and medium flow anadromous fish streams; (2) Primary prey species consisting of four species of Pacific salmon (Chinook, sockeye, chum, and coho), Pacific eulachon, Pacific cod, walleye pollock, saffron cod, and yellowfin sole, (3) Waters free of toxins or other agents of a type and amount harmful to CIBWs, (4) Unrestricted passage within or between the critical habitat areas, and (5) Waters with in-water noise below levels resulting in the abandonment of critical habitat areas by CIBWs. The NES1 project will not impact essential features 1–3 listed above. All construction will be done in a manner implementing best management practices to preserve water quality, and no work will occur around creek mouths or river systems leading to prey abundance reductions. In addition, no physical structures will restrict passage; however, impacts to the acoustic habitat are relevant and discussed here.

Monitoring data from the POA suggest pile driving does not discourage CIBWs from entering Knik Arm and traveling to critical foraging grounds such as those around Eagle Bay (*e.g.,* 61N Environmental, 2021, 2022a, 2022b; Easley-Appleyard and Leonard, 2022). As described in the Potential Effects of Specified Activities on Marine Mammals and Their Habitat section of this notice, sighting rates were not different in the presence or absence of pile driving (Kendall and Cornick, 2015). In addition, large numbers of CIBWs have continued to use Knik Arm and pass through the area during pile driving projects that have taken place at the POA during the past two decades (Funk *et al.,* 2005; Prevel-Ramos *et al.,* 2006; Markowitz and McGuire, 2007; Cornick and Saxon-Kendall, 2008, 2009; ICRC, 2009, 2010, 2011, 2012; Cornick *et al.,* 2010, 2011; Cornick and Pinney, 2011; Cornick and Seagars, 2016; POA, 2019), including during the recent PCT and SFD construction projects (61N Environmental, 2021, 2022a, 2022b; Easley-Appleyard and Leonard, 2022). These findings are not surprising as food is a strong motivation for marine mammals. As described in Forney *et al.* (2017), animals typically favor particular areas because of their importance for survival (*e.g.,* feeding or breeding), and leaving may have significant costs to fitness (reduced foraging success, increased predation risk, increased exposure to other anthropogenic threats). Consequently, animals may be highly motivated to maintain foraging behavior in historical foraging areas despite negative impacts (*e.g.,* Rolland *et al.,* 2012). Previous monitoring data indicates CIBWs are responding to pile driving noise, but not through abandonment of critical habitat, including primary foraging areas north of the port. Instead, they travel more often and faster past the POA, more quietly, and in tighter groups (Kendall and Cornick, 2015; 61N Environmental, 2021, 2022a, 2022b).

During PCT and SFD construction monitoring, little variability was evident in the behaviors recorded from month to month, or between sightings that coincided with in-water pile installation and removal and those that did not (61N Environmental, 2021, 2022a, 2022b; Easley-Appleyard and Leonard, 2022). Of the 386 CIBWs groups sighted during PCT and SFD construction monitoring, 10 groups were observed during or within minutes of in-water impact pile installation and 56 groups were observed during or within minutes of vibratory pile installation or removal (61N Environmental, 2021, 2022a, 2022b). In general, CIBWs were more likely to display no reaction or to continue to move towards the PCT or SFD during pile installation and removal. In the situations during which CIBWs showed a possible reaction (six groups during impact driving and 13 groups during vibratory driving), CIBWs were observed either moving away immediately after the pile driving activities started or were observed increasing their rate of travel.

NMFS funded a visual marine mammal monitoring project in 2021 (described in the Potential Effects of Specified Activities on Marine Mammals and Their Habitat) to supplement sighting data collected by the POA monitoring program during non-pile driving days in order to further evaluate the impacts of anthropogenic activities on CIBWs (Easley-Appleyard and Leonard, 2022). Preliminary results suggest that group size ranged from 1 to 34 whales, with an average of 3 to 5.6, depending on the month. September had the highest sighting rate with 4.08 whales per hour, followed by October and August (3.46 and 3.41, respectively). Traveling was recorded as the primary behavior for 80 percent of the group sightings and milling was the secondary behavior most often recorded. Sighting duration varied from a single surfacing lasting less than 1 minute to 380 minutes. Preliminary findings suggest these results are consistent with the results from the POA's PCT and SFD monitoring efforts. For example, group sizes ranged from 2.38 to 4.32 depending on the month and the highest sighting rate was observed in September (1.75). In addition, traveling was the predominant behavior observed for all months and categories of construction activity (*i.e.,* no pile driving, before pile driving, during pile driving, between pile driving, or after pile driving), being recorded as the primary behavior for 86 percent of all sightings, and either the primary or secondary behavior for 95 percent of sightings.

Easley-Appleyard and Leonard (2022) also asked PSOs to complete a questionnaire post-monitoring that provided NMFS with qualitative data regarding CIBW behavior during observations. Specifically during pile driving events, the PSOs noted that CIBW behaviors varied; however, multiple PSOs noted seeing behavioral changes specifically during impact pile driving (which would only be used when necessary to loosen piles for vibratory removal or direct pulling during the NES1 project) and not during vibratory pile driving. CIBWs were observed sometimes changing direction, turning around, or changing speed during impact pile driving. There were numerous instances where CIBWs were seen traveling directly towards the POA during vibratory pile driving before entering the Level B harassment zone (POA was required to shutdown prior to CIBWs entering the Level B harassment zone), which is consistent with findings during the POA's PCT and SFD monitoring efforts (61N Environmental, 2021, 2022a, 2022b). The PSOs also reported that it seemed more likely for CIBWs to show more cryptic behavior during pile driving (*e.g.,* surfacing infrequently and without clear direction), though this seemed to vary across months (Easley-Appleyard and Leonard, 2022).

We anticipate that disturbance to CIBWs will manifest in the same manner when they are exposed to noise during the NES1 project: whales would move quickly and silently through the area in more cohesive groups. We do not believe exposure to elevated noise levels during transit past the POA has adverse effects on reproduction or survival as the whales continue to access critical foraging grounds north of the POA, even if having shown a potential reaction during pile driving, and tight associations help to mitigate the potential for any contraction of communication space for a group. We also do not anticipate that CIBWs will abandon entering or exiting Knik Arm, as this is not evident based on previous years of monitoring data (*e.g.,* Kendall and Cornick, 2015; 61N Environmental, 2021, 2022a, 2022b; Easley-Appleyard and Leonard, 2022), and the pre-pile driving clearance mitigation measure is designed to further avoid any potential abandonment. Finally, as described previously, both telemetry (tagging) and acoustic data suggest CIBWs likely stay in upper Knik Arm (*i.e.,* north of the NES1 project site) for several days or weeks before exiting Knik Arm. Specifically, a CIBW instrumented with a satellite link time/depth recorder entered Knik Arm on August 18, 1999 and remained in Eagle Bay until September 12, 1999 (Ferrero *et al.,* 2000). Further, a recent detailed re-analysis of the satellite telemetry data confirms how several tagged whales exhibited this same movement pattern: whales entered Knik Arm and remained there for several days before exiting through lower Knik Arm (Shelden *et al.,* 2018). This longer-term use of upper Knik Arm will avoid repetitive exposures from pile driving noise.

There is concern that exposure to pile driving at the POA could result in CIBWs avoiding Knik Arm and thereby not accessing the productive foraging grounds north of POA such as Eagle River flats thus, impacting essential feature number five above. Although the data previously presented demonstrate CIBWs are not abandoning the area (*i.e.,* no significant difference in sighting rate with and without pile driving), results of an expert elicitation (EE) at a 2016 workshop, which predicted the impacts of noise on CIBW survival and reproduction given lost foraging opportunities, helped to inform our assessment of impacts on this stock. The 2016 EE workshop used conceptual models of an interim population consequences of disturbance (PCoD) for marine mammals (NRC, 2005; New *et al.,* 2014; Tollit *et al.,* 2016) to help in understanding how noise-related stressors might affect vital rates (survival, birth rate and growth) for CIBW (King *et al.,* 2015). NMFS (2016b) suggests that the main direct effects of noise on CIBW are likely to be through masking of vocalizations used for communication and prey location and habitat degradation. The 2016 workshop on CIBWs was specifically designed to provide regulators with a tool to help understand whether chronic and acute anthropogenic noise from various sources and projects are likely to be limiting recovery of the CIBW population. The full report can be found at *https://www.smruconsulting.com/publications/* with a summary of the expert elicitation portion of the workshop below.

For each of the noise effect mechanisms chosen for EE, the experts provided a set of parameters and values that determined the forms of a relationship between the number of days of disturbance a female CIBW experiences in a particular period and the effect of that disturbance on her energy reserves. Examples included the number of days of disturbance during the period April, May, and June that would be predicted to reduce the energy reserves of a pregnant CIBW to such a level that she is certain to terminate the pregnancy or abandon the calf soon after birth, the number of days of disturbance in the period April-September required to reduce the energy reserves of a lactating CIBW to a level where she is certain to abandon her calf, and the number of days of disturbance where a female fails to gain sufficient energy by the end of summer to maintain themselves and their calves during the subsequent winter. Overall, median values ranged from 16 to 69 days of disturbance depending on the question. However, for this elicitation, a ''day of disturbance'' was defined as any day on which an animal loses the ability to forage for at least one tidal cycle (*i.e.,* it forgoes 50–100 percent of its energy intake on that day). The day of disturbance considered in the context of the report is notably more severe than the Level B harassment expected to result from these activities, which as described is expected to be comprised predominantly of temporary modifications in the behavior of individual CIBWs (*e.g.,* faster swim speeds, more cohesive group structure, decreased sighting durations, cessation of vocalizations). Also, NMFS proposes to authorize 72 instances of takes, with the instances representing disturbance events within a day—this means that either 72 different individual CIBWs are disturbed on no more than 1 day each, or some lesser number of individuals may be disturbed on more than 1 day, but with the product of individuals and days not exceeding 72. Given the overall anticipated take, it is unlikely that any one CIBW will be disturbed on more than a few days. Further, the mitigation measures NMFS has prescribed for the NES1 project are designed to avoid the potential that any animal will lose the ability to forage for one or more tidal cycles should they be foraging in the proposed action area, which is not known to be a particularly important feeding area for CIBWs. While Level B harassment (behavioral disturbance) would be authorized, the POA's mitigation measures will limit the severity of the effects of that Level B harassment to behavioral changes such as increased swim speeds, tighter group formations, and cessation of vocalizations, not the loss of foraging capabilities. Regardless, this elicitation recognized that pregnant or lactating females and calves are inherently more at risk than other animals, such as males. NMFS has determined all CIBWs warrant pile driving shutdown to be protective of potential vulnerable life stages, such as pregnancy, that could not be determined from observations, and to avoid more severe behavioral reaction.

POA proposed and NMFS has prescribed mitigation measures to minimize exposure to CIBWs, specifically, shutting down pile driving should a CIBW approach or enter the Level B harassment zone. These measures are designed to ensure CIBWs will not abandon critical habitat and exposure to pile driving noise will not result in adverse impacts on the reproduction or survival of any individuals. The location of the PSOs would allow for detection of CIBWs and behavioral observations prior to CIBWs entering the Level B harassment zone. Further, impact driving appeared to cause behavioral reactions more readily than vibratory hammering (61N Environmental, 2021, 2022a, 2022b), which would only be used in situations where sheet piles remain seized in the sediments and cannot be loosened or broken free with a vibratory hammer, which is expected to be uncommon during the NES1 project. If impact driving does occur, the POA must implement soft starts, which ideally allows animals to leave a disturbed area before the full-power driving commences (Tougaard *et al.,* 2012). Although NMFS does not anticipate CIBWs will abandon entering Knik Arm in the presence of pile driving with the required mitigation measures, PSOs will be integral to identifying if CIBWs are potentially altering pathways they would otherwise take in the absence of pile driving. Finally, take by mortality, serious injury, or Level A harassment of CIBWs is not anticipated or proposed to be authorized.

In summary and as described above, the following factors primarily support our preliminary determination that the impacts resulting from this activity are not expected to adversely affect the CIBWs through effects on annual rates of recruitment or survival:

- No mortality is anticipated or proposed to be authorized;
- The area of exposure would be limited to habitat primarily used as a travel corridor. Data demonstrates Level B harassment of CIBWs typically manifests as increased swim speeds past the POA, tighter group formations, and cessation of vocalizations, rather than through habitat abandonment;
- No critical foraging grounds (*e.g.,* Eagle Bay, Eagle River, Susitna Delta) would be impacted by pile driving; and
- While animals could be harassed more than once, exposures are not likely to exceed more than a few per year for any given individual and are not expected to occur on sequential days; thereby decreasing the likelihood of physiological impacts caused by chronic stress or masking.

Based on the analysis contained herein of the likely effects of the specified activity on marine mammals and their habitat, and taking into consideration the implementation of the required monitoring and mitigation measures, NMFS preliminarily finds that the total marine mammal take from the specified activity will have a negligible impact on all affected marine mammal species or stocks.

Small Numbers

As noted previously, only take of small numbers of marine mammals may be authorized under sections 101(a)(5)(A) and (D) of the MMPA for specified activities other than military readiness activities. The MMPA does not define small numbers and so, in practice, where estimated numbers are available, NMFS compares the number of individuals taken to the most appropriate estimation of abundance of the relevant species or stock in our determination of whether an authorization is limited to small numbers of marine mammals. When the predicted number of individuals to be taken is fewer than one-third of the species or stock abundance, the take is considered to be of small numbers. Additionally, other qualitative factors may be considered in the analysis, such as the temporal or spatial scale of the activities.

For all stocks, except for the Mexico-North Pacific stock of humpback whales whose abundance estimate is unknown, the amount of taking is less than one-third of the best available population abundance estimate (in fact it is less than 2 percent for all stocks, except for CIBWs whose proposed take is 22 percent of the stock; Table 14). The number of animals proposed for authorization to be taken from these stocks would be considered small relative to the relevant stock's abundances even if each estimated take occurred to a new individual. The amount of take authorized likely represents smaller numbers of individual harbor seals and Steller sea lions. Harbor seals tend to concentrate near Ship Creek and have small home ranges. It is possible that a single individual harbor seal may linger near the POA, especially near Ship Creek, and be counted multiple times each day as it moves around and resurfaces in different locations. Previous Steller sea lion sightings identified that if a Steller sea lion is within Knik Arm, it is likely lingering to forage on salmon or eulachon runs and may be present for several days. Therefore, the amount of take authorized likely represents repeat exposures to the same animals. For all species, PSOs would count individuals as separate unless they cannot be individually identified.

Abundance estimates for the Mexico-North Pacific stock of humpback whales are based upon data collected more than 8 years ago and, therefore, current estimates are considered unknown (Young *et al.,* 2023). The most recent minimum population estimates (N_{MIN}) for this population include an estimate of 2,241 individuals between 2003 and 2006 (Martinez-Aguilar, 2011) and 766 individuals between 2004 and 2006 (Wade, 2021). NMFS' Guidelines for Assessing Marine Mammal Stocks suggest that the N_{MIN} estimate of the stock should be adjusted to account for potential abundance changes that may have occurred since the last survey and provide reasonable assurance that the stock size is at least as large as the estimate (NMFS, 2023). The abundance trend for this stock is unclear; therefore, there is no basis for adjusting these estimates (Young *et al.,* 2023). Assuming the population has been stable, the 4 takes of this stock proposed for authorization represents small numbers of this stock (0.18 percent of the stock assuming a N_{MIN} of 2,241 individuals and 0.52 percent of the stock assuming an N_{MIN} of 766 individuals).

Based on the analysis contained herein of the proposed activity (including the proposed mitigation and monitoring measures) and the anticipated take of marine mammals, NMFS preliminarily finds that small numbers of marine mammals would be taken relative to the population size of the affected species or stocks.

Unmitigable Adverse Impact Analysis and Determination

In order to issue an IHA, NMFS must find that the specified activity will not have an ''unmitigable adverse impact'' on the subsistence uses of the affected marine mammal species or stocks by Alaskan Natives. NMFS has defined ''unmitigable adverse impact'' in 50 CFR 216.103 as an impact resulting from the specified activity: (1) That is likely to reduce the availability of the species to a level insufficient for a harvest to meet subsistence needs by: (i) Causing the marine mammals to abandon or avoid hunting areas; (ii) Directly displacing subsistence users; or (iii) Placing physical barriers between the marine mammals and the subsistence hunters; and (2) That cannot be sufficiently mitigated by other measures to increase the availability of marine mammals to allow subsistence needs to be met.

While no significant subsistence activity currently occurs within or near the POA, Alaska Natives have traditionally harvested subsistence resources, including marine mammals, in upper Cook Inlet for millennia. CIBWs are more than a food source; they are important to the cultural and spiritual practices of Cook Inlet Native communities (NMFS, 2008b). Dena'ina Athabascans, currently living in the communities of Eklutna, Knik, Tyonek, and elsewhere, occupied settlements in Cook Inlet for the last 1,500 years and have been the primary traditional users of this area into the present.

NMFS estimated that 65 CIBWs per year (range 21–123) were killed between 1994 and 1998, including those successfully harvested and those struck and lost. NMFS concluded that this number was high enough to account for the estimated 14 percent annual decline in population during this time (Hobbs *et al.,* 2008); however, given the difficulty of estimating the number of whales struck and lost during the hunts, actual mortality may have been higher. During this same period, population abundance surveys indicated a population decline of 47 percent, although the reason for this decline should not be associated solely with subsistence hunting and likely began well before 1994 (Rugh *et al.,* 2000).

In 1999, a moratorium was enacted (Pub. L. 106–31) prohibiting the subsistence harvest of CIBWs except through a cooperative agreement between NMFS and the affected Alaska Native organizations. NMFS began working cooperatively with the Cook Inlet Marine Mammal Council (CIMMC), a group of tribes that traditionally hunted CIBWs, to establish sustainable harvests. CIMMC voluntarily curtailed its harvests in 1999. In 2000, NMFS designated the Cook Inlet stock of beluga whales as depleted under the MMPA (65 FR 34590, May 31, 2000). NMFS and CIMMC signed Co-Management of the Cook Inlet Stock of Beluga Whales agreements in 2000, 2001, 2002, 2003, 2005, and 2006. CIBW harvests between 1999 and 2006 resulted in the strike and harvest of five whales, including one whale each in 2001, 2002, and 2003, and two whales in 2005 (NMFS, 2008b). No hunt occurred in 2004 due to higher-than-normal mortality of CIBWs in 2003, and the Native Village of Tyonek agreed to not hunt in 2007. Since 2008, NMFS has examined how many CIBWs could be harvested during 5-year intervals based on estimates of population size and growth rate and determined that no harvests would occur between 2008 and 2012 and between 2013 and 2017 (NMFS, 2008b). The CIMMC was disbanded by unanimous vote of the CIMMC member Tribes' representatives in June 2012, and a replacement group of Tribal members has not been formed to date. There has been no subsistence harvest of CIBWs since 2005 (NMFS, 2022d).

Subsistence harvest of other marine mammals in upper Cook Inlet is limited to harbor seals. Steller sea lions are rare in upper Cook Inlet; therefore, subsistence use of this species is not common. However, Steller sea lions are taken for subsistence use in lower Cook Inlet. Residents of the Native Village of Tyonek are the primary subsistence users in the upper Cook Inlet area. While harbor seals are hunted for subsistence purposes, harvests of this for traditional and subsistence uses by Native peoples have been low in upper Cook Inlet (*e.g.,* 33 harbor seals were harvested in Tyonek between 1983 and 2013; see Table 8–1 in the POA's application), although these data are not currently being collected and summarized. As the POA's proposed project activities will take place within the immediate vicinity of the POA, no activities will occur in or near Tyonek's identified traditional subsistence hunting areas. As the harvest of marine mammals in upper Cook Inlet is historically a small portion of the total subsistence harvest, and the number of marine mammals using upper Cook Inlet is proportionately small, the number of marine mammals harvested in upper Cook Inlet is expected to remain low.

The potential impacts from harassment on stocks that are harvested in Cook Inlet would be limited to minor behavioral changes (*e.g.,* increased swim speeds, changes in dive time, temporary avoidance near the POA, *etc.*) within the vicinity of the POA. Some PTS may occur; however, the shift is likely to be slight due to the implementation of mitigation measures (*e.g.,* shutdown zones, pre-clearance monitoring, soft starts) and the shift would be limited to lower pile driving frequencies which are on the lower end of phocid and otariid hearing ranges. In summary, any impacts to harbor seals would be limited to those seals within Knik Arm (outside of any hunting area) and the very few takes of Steller sea lions in Knik Arm would be far removed in time and space from any hunting in lower Cook Inlet.

The POA will communicate with representative Alaska Native subsistence users and Tribal members to identify and explain the measures that have been taken or will be taken to minimize any adverse effects of NES1 on the availability of marine mammals for subsistence uses. In addition, the POA will adhere to the following procedures during Tribal consultation regarding marine mammal subsistence use within the Project area:

(1) Send letters to the Kenaitze, Tyonek, Knik, Eklutna, Ninilchik, Salamatof, and Chickaloon Tribes informing them of the proposed project (*i.e.,* timing, location, and features). Include a map of the proposed project area; identify potential impacts to marine mammals and mitigation efforts, if needed, to avoid or minimize impacts; and inquire about possible marine mammal subsistence concerns they have.

(2) Follow up with a phone call to the environmental departments of the seven Tribal entities to ensure that they received the letter, understand the proposed project, and have a chance to ask questions. Inquire about any concerns they might have about potential impacts to subsistence hunting of marine mammals.

(3) Document all communication between the POA and Tribes.

(4) If any Tribes express concerns regarding proposed project impacts to subsistence hunting of marine mammals, propose a Plan of Cooperation between the POA and the concerned Tribe(s).

The proposed project features and activities, in combination with a number of actions to be taken by the POA during project implementation, should avoid or mitigate any potential adverse effects on the availability of marine mammals for subsistence uses. Furthermore, although construction will occur within the traditional area for hunting marine mammals, the proposed project area is not currently used for subsistence activities. In-water pile installation and removal will follow mitigation procedures to minimize effects on the behavior of marine mammals, and impacts will be temporary.

The POA has expressed, if desired, regional subsistence representatives may support project marine mammal biologists during the monitoring program by assisting with collection of marine mammal observations and may request copies of marine mammal monitoring reports.

Based on the description of the specified activity, the measures described to minimize adverse effects on the availability of marine mammals for subsistence purposes, and the proposed mitigation and monitoring measures, NMFS has preliminarily determined that there will not be an unmitigable adverse impact on subsistence uses from the POA's proposed activities.

Endangered Species Act

Section 7(a)(2) of the Endangered Species Act of 1973 (ESA; 16 U.S.C. 1531 *et seq.*) requires that each Federal agency insure 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 designated critical habitat. To ensure ESA compliance for the issuance of IHAs, NMFS Office of Protected Resources (OPR) consults internally whenever we propose to authorize take for endangered or threatened species, in this case with the NMFS Alaska Regional Office.

NMFS OPR is proposing to authorize take of Mexico-North Pacific humpback whales (including individuals from the Mexico DPS), CIBWs, and western DPS Steller sea lions, which are listed under the ESA. NMFS OPR has requested initiation of section 7 consultation with the issuance of this IHA. NMFS will conclude the ESA consultation prior to reaching a determination regarding the proposed issuance of the authorization.

Proposed Authorization

As a result of these preliminary determinations, NMFS proposes to issue an IHA to the POA for conducting construction and demolition activities in Anchorage Alaska from April 1, 2024 through March 31, 2025, provided the previously mentioned mitigation, monitoring, and reporting requirements are incorporated. A draft of the proposed IHA can be found at: *https://www.fisheries.noaa.gov/national/marine-mammal-protection/incidental-take-authorizations-construction-activities.*

Request for Public Comments

We request comment on our analyses, the proposed authorization, and any other aspect of this notice of proposed IHA for the proposed construction and demolition activities. We also request comment on the potential renewal of this proposed IHA as described in the paragraph below. Please include with your comments any supporting data or literature citations to help inform decisions on the request for this IHA or a subsequent renewal IHA.

On a case-by-case basis, NMFS may issue a one-time, 1-year renewal IHA following notice to the public providing an additional 15 days for public comments when (1) up to another year of identical or nearly identical activities as described in the Description of Proposed Activity section of this notice is planned or (2) the activities as described in the Description of Proposed Activity section of this notice would not be completed by the time the IHA expires and a renewal would allow for completion of the activities beyond that described in the *Dates and Duration* section of this notice, provided all of the following conditions are met:

- A request for renewal is received no later than 60 days prior to the needed renewal IHA effective date (recognizing that the renewal IHA expiration date cannot extend beyond 1 year from expiration of the initial IHA).
- The request for renewal must include the following:

(1) An explanation that the activities to be conducted under the requested renewal IHA are identical to the activities analyzed under the initial IHA, are a subset of the activities, or include changes so minor (*e.g.,* reduction in pile size) that the changes do not affect the previous analyses, mitigation and monitoring requirements, or take estimates (with the exception of reducing the type or amount of take).

(2) A preliminary monitoring report showing the results of the required monitoring to date and an explanation showing that the monitoring results do not indicate impacts of a scale or nature not previously analyzed or authorized.

Upon review of the request for renewal, the status of the affected species or stocks, and any other pertinent information, NMFS determines that there are no more than minor changes in the activities, the mitigation and monitoring measures will remain the same and appropriate, and the findings in the initial IHA remain valid.

Dated: October 30, 2023.

Kimberly Damon-Randall,

Director, Office of Protected Resources, National Marine Fisheries Service.

[FR Doc. 2023–24238 Filed 11–3–23; 8:45 am]

BILLING CODE 3510–22–P