APPENDIX H – ESA BIOLOGICAL ASSESSMENT – NMFS

National Marine Fisheries Service

Biological Assessment – Section 7

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ACRONYMS AND ABBREVIATIONS

%	percent
μPa	microPascal
4MP	Marine Mammal Monitoring and Mitigation
ac	acre(s)
AHT	anchor-handling tug
BA	Biological Assessment
BMP	Best Management Practice(s)
BSEE	Bureau of Safety and Environmental Enforcement
CFR	Code of Federal Regulation
cm	centimeter(s)
CWA	Clean Water Act
DA	Department of the Army
dB	decibel
DPS	Distinct Population Segment
ESA	Endangered Species Act
ft	foot/feet
ft^3	cubic feet
FR	Final Rule
gal	gallon(s)
ha	hectare(s)
hr	hour
Hz	hertz
IHA	Incidental Harassment Authorization
in	inch(s)
ITOPF	International Tank Owners Pollution Federation
kHz	kilohertz
km	kilometer
kt	knot(s)
LOC	Letter of Concurrence
m	meter(s)
m^3	cubic meters
mi	statute mile(s)
MMPA	Marine Mammal Protection Act
NMFS	National Marine Fisheries Service
NRC	National Research Council
Owl Ridge	Owl Ridge Natural Resource Consultants, Inc.
PCE	primary constituent elements

PIC	person in charge
PLP	Pebble Limited Partnership
PSO	Protected Species Observer(s)
PTS	permanent threshold shift
re	referenced at
RHA	Rivers and Harbors Act
rms	root mean square
ROW	right-of-way
SEL_{cum}	cumulative Sound Exposure Level
SFS	Scientific Fishery Systems, Inc.
SPL	sound pressure level
TTS	temporary threshold shift
U.S.	United States
USCG	U.S. Coast Guard
USFWS	U.S. Fish and Wildlife Service

1. INTRODUCTION

In December 2017, the Pebble Limited Partnership (PLP) submitted an application for a Department of the Army (DA) permit for the construction of a mine and ancillary facilities, a port facility, access roads, ferry terminals, and a natural gas pipeline (Project) (Figure 1).

Construction activities which require DA authorization under Section 404 of the Clean Water Act (CWA) include the temporary and permanent discharge of dredged or fill material into waters of the U.S. Activities which require DA authorization under Section 10 of the Rivers and Harbors Act (RHA) include: construct a causeway/wharf, install two lighted navigation buoys, install two spread anchor mooring systems (one for each lightering location), and install a natural gas pipeline below the mean high water mark of the Cook Inlet, which is a navigable water of the United States (U.S.); and construct two ferry terminals, install four mooring/navigation buoys, and install a natural gas pipeline below the ordinary high water mark of Iliamna Lake, which is a navigable water of the U.S.

Construction of the Project marine components, namely the causeway/wharf, installation of the two lighted navigation buoys, installation of the two spread anchor mooring systems at lightering locations, and installation of the natural gas pipeline below the mean high water mark of the Cook Inlet could encounter species listed under the Endangered Species Act of 1973 (ESA) at locations described in this Biological Assessment (BA).

Four species (Humpback whales, fin whales, beluga whales, and Steller sea lions) under ESA jurisdiction of the National Marine Fisheries Service (NMFS) are evaluated in this BA on the potential and magnitude of effect of activities to each of the listed species. Activities of the proposed project that could affect the listed species include: noise from construction vessel propulsion, pile driving, and placement of fill; discharges associated with the placement of fill or trenching; collision with construction vessels; incidental spills of petroleum when fueling construction equipment and other operational spills; displacement from feeding sites; and contamination effects to prey and foraging habitat. This BA also provides substantial detail on the listed species distribution, feeding, reproduction, natural mortality, designated critical habitat, and use of the proposed Action Area, all of which are necessary to conduct the detailed effects analysis.

Additional species under ESA jurisdiction of the U.S. Fish and Wildlife Service (USFWS) are addressed in a separate BA.

2. PROJECT ACTIVITIES AND ACTION AREA

2.1. Project Activities

The proposed Project will require federal authorizations for certain construction activities: DA authorization for the placement of fill under Section 404 of the CWA and construction activities in navigable waters of the U.S. under Section 10 of the RHA; Bureau of Safety and Environmental Enforcement (BSEE) authorization for the pipeline right-of-way (ROW) in Federal waters; and U.S. Coast Guard (USCG) authorization for bridges across Navigable Waters under Section 9 of the RHA. However, this BA only addresses those activities that would occur in marine waters that overlap with the historical ranges of listed species. All project construction activities addressed in this BA occurring in the marine waters of Cook Inlet below the mean high water mark will require Federal authorization. Those activities include: construct a causeway/wharf, install two lighted navigation buoys, install two spread anchor moorings systems (one at each lightering location), and install a natural gas pipeline below the mean high water mark of the Cook Inlet.

In-water port construction and lightering mooring placement would occur over two summer periods (May-September), and pipeline construction over one summer (June-August). Construction years have not been determined yet and are contingent on completion of permitting and detailed engineering design.

2.1.1. Port Construction

The marine portion of the proposed Amakdedori Port (Figure 2) is primarily comprised of a rock and earth berm access causeway and wharf (Figure 3) for mooring barges and other marine vessels. The proposed structure, which requires DA authorization under Section 10 of the RHA, is a 1,900 foot (ft) long by 500 ft wide (579 meters [m] x 152 m) causeway and wharf supporting a fuel unloading pipeline and utility lines.

The wharf will be an earth-filled sheet pile cell structure and will be constructed using a typical marine barge with crawler crane to vibrate and/or drive (impact) sheet pile segments into the seafloor. The cells will then be filled with select granular fill of rock/gravel. Wharf construction will involve the installation of 1,520 lineal ft (610 lineal m) of steel sheet piles approximately 110 ft (33.5 m) in length, with tie backs into the fill behind the sheets to provide sufficient lateral capacity. The sheet piles will be placed in approximately 15 ft (4.6 m) of water. The causeway will be constructed by infilling on top of the seabed with competent fill and rock protection for the slopes. The sheet piles will be installed using two vibratory hammers (APE 200 or similar). Estimated time to drive a pair of sheet piles ranges from 30 minutes to two hours. By assuming 4.6 lineal ft (1.4 lineal m) per pair, approximately 450 pairs are expected to be driven. Each hammer is expected to operate for six to eight hours over a 24-hour period given the need for cooling and maintenance. If bedrock or hard soil is encountered, a small diesel impact hammer (Delmag D36-32 or similar) may be necessary to anchor the last two feet (0.6 m) of piling into the ground. The impact hammer would operate up to two hours in a 24-hour period. The time estimated to complete pile driving is 90 days depending on weather contingency and the amount of hard ground encountered (requiring delays to change out hammers). All construction work would occur during the summer months.

Fill material for construction will be end dumped directly from trucks and/or transferred from shore onto a barge and placed using a clamshell bucket. The causeway will be constructed using a combination of a marine construction rig (barge and crane) to place coarse material for foundation and rip-rap protection, and land-based equipment working from shore to gradually place and compact locally sourced granular material that will be trucked to the site. Causeway fill placement will require a minimum of 135 days. Construction of the causeway and wharf will be completed over two summers from May through September.

2.1.2. Pipeline Construction

The primary energy source for the Project will be natural gas supplied via a 12-inches (in) (30.5-centimeters [cm]) pipeline originating near Anchor Point on the Kenai Peninsula (Figure 4). From Anchor Point the pipeline would head 104 miles (mi) (167 kilometers [km]) across Cook Inlet to a landfall at the Amakdedori Port. A fiber optic cable would be buried adjacent to the pipeline. DA authorization under Section 10 of the RHA will be required for the construction of 104 mi of 12-in pipeline below the mean high-water mark.

The natural gas pipeline would be installed by directional drilling, laying the pipeline on the substrate, or trenching, using a clam shell dredge, extended reach backhoe, suction dredge, or jet sled working from barges up to 240 ft long x 60 ft wide (73.2 m x 18.3 m).

The pipe will be laid using a conventional pipe-lay barge which involves a non-motorized barge that is moved by picking up and moving the 8 to 12 anchors used to hold it in place while pipe is welded together and laid over the back of the barge. Anchor-handling tugs (AHTs) will be used to reposition the anchors that keep the barge properly positioned. Pipeline construction would occur in the months of June through August of a single year and it would take approximately 30 to 40 days to install the pipe, plus an additional 30 to 60 days of pre- and post-pipe laying activities.

2.1.3. Spread Anchor Mooring Placements

The project will require the placement of anchors for mooring bulk carriers at two lightering locations (Figures 2 and 5):

1. A primary lightering location (Location A) approximately 12 mi (19 km) offshore due east of the proposed Amakdedori Port.
2. An alternative lightering location (Location B) approximately 18 mi (29 km) east-northeast of the proposed Amakdedori Port between Augustine Island and the mainland.

Both locations are outside of the Cook Inlet beluga whale designated critical habitat (Figure 5). The proposed mooring structures, which require DA authorization under Section 10 of the RHA, include two 2,300 ft x 1,700 ft (700 m x 520 m) spread anchor mooring systems in approximately 80 ft (25 m) of water, each consisting of 10 anchors and 6 mooring buoys. The typical spread anchor mooring system, and typical anchor arrangement designs are shown in Figure 6 and Figure 7 respectively.

Each 10-ft (3.05 m) diameter mooring buoy would be tethered by lengths of 2-in (5.1 cm) diameter chain attached to 3 gravity anchors; first to a station keeping mass anchor, typically a 3 ft x 3 ft x 3 ft (7.4 m x 7.6 m x 7.6 m) concrete block, and secondly to 2 large mass anchors connected by chain equalizers (Figure 7). The typical large mass anchor is a rock/concrete filled 40 ft x 8 ft x 8 ft (101.6 m x 20.3 m x 20.3 m) shipping container that is lowered to the sea floor. Alternatives that might be used if sea floor conditions are not suitable for gravity anchors include:

- Large spade anchors (similar to a conventional boat anchor)

- Spiral screw anchors that would be twisted into the seabed using a hydraulic drill
- Anchors that are drilled into the seabed

Construction of each anchor point would require approximately one day of work at the site. If a drilled anchor is required, it would take 1 to 4 hours of drilling time within the day to prepare the hole for a grouted anchor or to directly drill in the screw anchor. It would take 10 to 12 days to establish all the anchors at each lightering location, or 20 to 24 days of work for both locations. The work would be performed from a barge with support tugs and a supply vessel.

However, other than noise disturbance (e.g., rock drilling) addressed in this BA, there are no effects from this activity on ESA-listed species.

2.1.4. Navigation Buoy Placement

Two lighted navigation buoys will be placed on the reefs framing the entrance to the Amakdedori Port. The 3-ft (0.91 m) diameter buoys will be anchored to the reef using screw anchors twisted into the seabed or 3-ft^3 (0.91 m^3) concrete block anchors, with an anchoring design that prevents excessive anchor chain drag or swinging. Heavy 2-in (5.1-cm) anchor chain will be used to keep the chain taught and prevent kinking. Placement of the buoys would take one day per site, for a total of two days.

No impacts to listed species is expected from placement of navigation buoys.

2.2. Action Area

The Project Action Area is shown in Figure 8 and defined as follows:

The Action Area for the causeway and wharf construction is based on in-water construction activities and the underwater acoustical footprint due to in water impact pile driving to the 160-decibel (dB) sound pressure level (SPL) isopleth and vibratory pile driving and fill placement to the 120-dB SPL isopleth. As described in Section 2.1.1 only sheet pile will be utilized in the wharf construction. The sheet pile will be installed primarily using vibratory hammers, but the use of an impact hammer may be required for the final placement of the sheet pile. Impact installation will utilize sound mitigation such as bubble curtains to help reduce the acoustical footprint.

Dickerson et al. (2001) measured noise levels produced by in-water construction activities including material placement, and trenching. The measured underwater noise level of a barge offloading material into water was 109 dB SPL at 1,037 ft (316 m) equating to radial distance of 190 ft (58 m) to the 120-dB SPL isopleth based on the 15 Log (r) practical spreading model.

URS (2007) measured impact pile driving of unattenuated 14-inch H piles and sheet piles at Anchorage in 2007 in association with the Port of Anchorage's Marine Terminal development project. They found that the distance to the 160-dB isopleth was 1,148 ft (350 m). Scientific Fishery Systems (SFS 2009) also conducted acoustical measurements of impact driving sheet pile at the Port of Anchorage. They estimated the maximum source at 199.73 dB referenced at (re) 1 μPa root mean square (rms) and the distance to the 160-dB isopleth at 318 ft (97 m), based on a 20 Log (r) spherical spreading model, or 1,460 ft (445 m) using the 15 Log (r) practical spreading model.

Determining the radial distance to the 120-dB isopleth for vibratory pile driving activity is problematic because the actual isopleth is usually well beyond the distance sound sensors are placed necessitating the need to extrapolate using transmission loss coefficients estimated from data collected near the sound source. The radial distance is a function of the sound pressure levels at the source and transmission loss over distance, and measured transmission loss in the near field may not reflect the transmission loss in the far field. The forces that degrade sound signals over distance (bottom substrate, water surface texture, suspended particles, plankton, tide noise) have less effect in the near field but can cause a quick drop off in the far field. Depending on the location of the sensor, both the estimated sound level at source and at the 120-dB isopleth may be exaggerated if the change in transmission loss rate over distance is not measured. Case in point, URS (2007) measured vibratory driving of sheet pile at the Port of Anchorage conservatively estimated the distance to the 120-dB isopleth would be 2,625 ft (800 m) as all measurements at this distance were below 120 dB re 1 μPa (rms). However, SFS (2009) repeated the sound study and estimated the worst-case distance to the 120-dB threshold at 5.1 mi (8.2 km), a magnitude higher, as they measured maximum sound pressure levels well above 120 dB re 1 μPa (rms) at 2,484 ft (757 m) from the source. Their results indicated that tide levels had a major effect on sound propagation as transmission loss was significantly higher (and radial distances significantly lower) during low tide. SFS's (2009) worst-case analysis was based on a 20 Log (r) spherical spreading loss coefficient, which may be appropriate based on other Cook Inlet pile driving studies (Blackwell 2005). However, SFS (2009) did note that a transmission loss coefficient of 16 Log (r) would result in a 9.25 mi (14.9 km) distance to the 120-dB isopleth, while a 15 Log (r) practical spreading model would yield a result of 11.3 mi (18.2 km). Denes et al. (2016) measured vibratory driving of sheet pile at Kodiak estimated a 90th percentile (33-ft, 10-m) source of 160 dB re 1 μPa (rms). Based on this source, the radial distance to the 120-dB isopleth would range from 0.6 mi (1 km) using the spherical spreading model to 2.9 mi (4.6 km) using the practical spreading model. A worst-case, based on single maximum value of 164.8 dB re 1 μPa (rms) at 33 ft (10 m) results in a range of 1.1 mi (1.7 km) to 6 mi (9.7 km). The above studies indicate that radial distances for vibratory driving of sheet pile in Cook Inlet could range from a measured 2,625 ft (800 m) to a conservatively estimated 11.3 mi (18.2 km). The practical spreading model was used to estimate distances to thresholds where local measurements are not available, and thus the 11.3-mi (18.2-km) radial distance represents a conservative measure to estimate the Action Area for vibratory pile driving activities at the proposed Amakdedori Port and represents the Action Area for all three noise producing activities during port construction (impact and vibratory pile driving, and fill placement) (Table 1).

The Action Area for the pipeline construction is based on the total corridor width that may experience temporary impacts due to the pipeline construction. The loudest noise levels associated with pipeline construction would be due to thruster use by small tugs during handling of the pipeline barge anchors. However, NMFS no longer considers the noise levels associated with these activities to rise to the level of take (83 Final Rule [FR] 7655 dated 02/22/2018). Therefore, the Action Area corridor width is based on seafloor disturbance, or the maximum distance from the pipeline centerline that the anchors for the lay barge may be placed, a distance of 4,101 ft (1,250 m) on either side of the pipeline centerline, or a total corridor width of 8,202 ft (2,500 m) (Table 1).

The Action Area for the spread anchor mooring system is based on the physical footprint of the two mooring facilities where the anchors will be placed, a 2,300 ft x 1,700 ft (700 m x 520 m) rectangle centered around the mooring locations, equating to an approximate 1,150-ft (350-m) radial distance (Table 1). Anchor placement might require shallow rock drilling to place a screw anchor. Should that be necessary, PLP will choose a method that produces the lowest underwater noise levels combined with a short-operation period. The short-term disturbance associated with drilling a few anchor holes does not rise to the level of take.

The Action Area for the placement of the navigation buoys is based on the area that may be disturbed during the buoy anchor placement, a circular area of 33 ft (10 m) centered around the buoy locations (Table 1).

Table 1: Radial distances for determining Action Area.

Activity	Radial Distance
Port Construction	11.3 mi (18.2 km)
Pipeline Construction	4,101 ft (1,250 m)
Spread Anchor Mooring System	1,150 ft (350 m)
Navigation Buoy Placement	33 ft (10 m)

3. SPECIES POTENTIALLY AFFECTED

Four species of marine mammals, currently listed under the ESA and under the jurisdiction of NMFS, occur seasonally or year-round within the Action Area (Table 2). Humpback whales from the threatened Mexico Distinct Population Segment (DPS) typically summer off the Pacific Northwest, while whales from the endangered Western North Pacific DPS largely summer of Kamchatka. However, a small fraction of both populations have been found in Gulf of Alaska waters (Wade et al. 2016). The majority of humpback whales found in lower Cook Inlet are from the Hawaii DPS, which was delisted in 2016. The threatened Cook Inlet beluga whale summers in upper Cook Inlet with a portion of the population wintering in lower Cook Inlet venturing as far south as Kamishak Bay. Steller sea lions breed on the Barren Islands at the mouth of Cook Inlet and can be found feeding throughout the lower inlet and have been observed as far north as the Port of Anchorage, Alaska. The listed fin whale is found near the mouth of lower Cook Inlet, although there are few records from inside Cook Inlet.

Table 2: NMFS-listed species occurring within the project Action Area.[1]

Common Name	Latin Name	ESA Status	Population
Humpback Whale	*Megaptera novaeangliae*	Threatened	Mexico DPS
Humpback Whale	*Megaptera novaeangliae*	Endangered	Western North Pacific DPS
Fin Whale	*Balaenoptera physalus*	Endangered	North Pacific
Beluga Whale	*Delphinapterus leucas*	Threatened	Cook Inlet Stock
Steller Sea Lion	*Eumetopias jubatus*	Threatened	Western DPS

Note:
1 Obtained from the NMFS Alaska Protected Resource Division website mapper [https://www.fisheries.noaa.gov/resource/data/alaska-endangered-species-and-critical-habitat-mapper-web-application] on September 15, 2018.

4. STATUS OF LISTED SPECIES

Four ESA-listed species under the jurisdiction of the NMFS have been identified as occurring within the Action Area (Table 2). The ESA status, biological status, and use of the Action Area of each are addressed below.

4.1. Humpback Whale (*Megaptera novaeangliae*)

4.1.1. ESA Status

The humpback whale, as with most great whales, was protected under international convention in 1966, although illegal whaling continued to occur well into the 1970s and possibly 1980s. They were listed as endangered under the Endangered Species Conservation Act in 1969, and again under the ESA in 1973. On September 8, 2016, NMFS publish a rule, effective October 11, 2016, stating that ESA protection for the Hawaii DPS (Central North Pacific stock) is no longer warranted, while the Mexico DPS (California/Oregon/Washington stock) was down-listed to threatened status. The small Western North Pacific DPS (Western North Pacific stock) remains endangered. There is no designated critical habitat, but a recovery plan was finalized in 1991.

4.1.2. Biological Status

4.1.2.1. Abundance and Trends

There are numerous population estimates for North Pacific humpback whales and they vary depending on survey and modeling techniques. An intensive 3-year (2004-2006) photo-identification study (Structures of Population, Levels of Abundance and Status of Humpback Whales [SPLASH]) was conducted to determine the population structure and abundance of North Pacific humpback whale populations (Calambokidis et al. 2008, Wade et al. 2016). The results of the study provided a best estimate overall abundance of 18,302 for the entire North Pacific, or an estimate higher than the pre-exploitation population estimated by Rice (1974). The SPLASH data (Calambokidis et al. 2008, Barlow et al. 2011) provided estimates for the three North Pacific humpback whale stocks occurring in the Action Area (see *Distribution and Habitat Use* below): California/Oregon/Washington stock - 2,034; Central North Pacific stock - 10,103; and Western North Pacific stock - 1,107. Combined, these three stocks represent 72 percent of the current North Pacific population. Since protection in 1966, the North Pacific population has grown at an annual rate of about 6 percent to 7 percent (Carretta et al. 2016). Muto et al. (2018) identify the annual rate of increase as at least 7 percent.

4.1.2.2. Distribution and Habitat Use

Humpback whales are coastal in their habitat use and generally are found in shelf edge, shelf, and inland waters. Three stocks of humpback whales potentially inhabit the Action Area. The California/Oregon/Washington stock (Mexico DPS) winters in the nearshore waters off Mexico and Central America, and summers off California, Oregon, and Washington. The Central North Pacific stock (Hawaii DPS) winters in Hawaiian waters and migrates to summer feeding areas in the coastal waters of British Columbia, Southeast Alaska, the Gulf of Alaska, the eastern Bering Sea, and the Aleutian Islands. The California/Oregon/Washington and Central North Pacific stocks overlap in southern British Columbia. The

Western North Pacific stock (Western North Pacific DPS) winters off the coast of Asia and primarily summers in Russian waters, although it overlaps with the summer distribution of the Central North Pacific stock in the Bering Sea and along the Aleutians. Based on genetic analysis and movements of known animals, there appears to be some annual interchange between these three stocks, and all three stocks can be found in the Gulf of Alaska (Wade et al. 2016). On September 8, 2016, NMFS provided humpback whale guidance indicating that individuals from all three of the above stocks, identified by Wade et al. (2016) as the Mexico, Hawaii, and Western North Pacific DPS, can occur in the Gulf of Alaska summer feeding grounds. The majority (89%) of the whales that were photo-identified were from the Hawaii DPS and 10.5 percent from the Mexico DPS (Wade et al. 2016). Only 0.5 percent were from the Western North Pacific DPS. While there is no indication that humpback whales inhabiting lower Cook Inlet are from either stock that remains listed (the Mexico DPS and Western North Pacific DPS), the possibility cannot be precluded given the distance that some of the whales from these stocks annually range.

4.1.2.3. Feeding and Prey Selection

For the most part, humpback whales prey on krill and schooling fish with the composition dependent on the feeding location. The most important prey off California are anchovies and the krill species *Euphausia pacifica* (Rice 1963). This and other species of krill are important in Alaska along with Pacific herring (Frost and Lowry 1981, Krieger and Wing 1984). Nemoto (1957) found stomachs of humpbacks taken during Japanese whaling in the North Pacific to contain almost entirely euphausiids. There is no information on humpback diet in lower Cook Inlet, although both krill and small schooling fish are available.

4.1.2.4. Reproduction

Humpback whale calving and breeding occurs on the warmer-watered wintering grounds. The high population growth rate (average annual rate of 6% to 7%) since the 1960s is partially explained by a higher reproduction rate compared to other large whales. Females sexually mature at 4 to 6 years of age and gestation periods are less than 12 months (NMFS 1991). The calving interval is generally 2 to 3 years, but some whales have calved in consecutive years (NMFS 1991).

4.1.2.5. Natural Mortality

Identified natural mortality in the North Pacific has been limited to occasional killer whale predation, although red tide events and possibly parasite overload has been implicated in deaths of North Atlantic humpback whales (NMFS 1991). Killer whales have been observed killing humpbacks in Southeast Alaska (Dolphin 1987), and the rake marks on whale flukes have been attributed to killer whale attacks, although there is speculation that some marks are due to attacks on juveniles by false killer whales (*Pseudorca crassidens*) on Hawaiian wintering grounds (NMFS 1991).

4.1.2.6. Threats

The final humpback whale recovery plan (NMFS 1991) identified six threats at the time of publication that could potentially impede recovery of the species at large: subsistence hunting, fishing gear entanglement, ship strike, acoustical disturbance, habitat degradation, and competition for resources with humans. Subsistence hunting is not a threat of concern in the North Pacific, and while humans do utilize resources that are food for Alaskan humpback whales (e.g., Pacific herring), there is not yet any evidence that competition is negatively affecting whales. Ship strike is an issue, as humpback whales are one of the more vulnerable whales to ship strike (Jensen and Silber 2004) largely because they occur in continental shelf waters where ship traffic is greatest, and they are the most commonly struck in Alaska (Neilson et al. 2012). Neilson et al. 2004 studied humpback whale entanglement in Southeast Alaska and discovered that between 52 percent and 78 percent of the whales examined bore unambiguous scars from gear entanglement, a identified cause of mortality (Muto et al. 2018).

4.1.2.7. Acoustical Ecology

Humpbacks produce a variety of vocalizations ranging from 20 hertz (Hz) to 10 kilohertz (kHz) to locate prey, coordinate communal feeding efforts, attract mates, and for mother-calf communication (Au et al. 2004, Vu et al. 2012). NMFS categorizes humpback whales in the low-frequency cetacean functional hearing group, with an applied frequency range between 7 Hz and 35 kHz (NMFS 2018). Depending on its strength and duration, anthropogenic noise can result in social disturbance, physical discomfort, and masking of intraspecific humpback communication. Although difficult to detect visually, evidence that individual humpbacks are responding to elevated noise levels has been inferred by whales leaving/avoiding ensonified areas and reducing the duration and frequency of intraspecific vocalizations (NRC 2005, Nowacek et al. 2007).

4.1.3. Species Use of the Action Area

Humpback whales are regularly sighted during Kachemak Bay whale-watching tours based out of Homer and have been recently recorded within the proposed pipeline construction Action Area near Anchor Point (Owl Ridge Natural Resource Consultants Inc. [Owl Ridge] 2014). Small numbers are regularly observed during annual/biennial beluga whale surveys conducted by NMFS, generally south of Anchor Point, but within the Action Area (Figure 9). NMFS did not record humpbacks inhabiting Kamishak Bay, but ABR (Figure 10) did observe a few humpback whales within the bay southwest of Augustine Island in 2018. Small numbers of humpback whales are expected to seasonally (summer/fall) occur within the Action Area.

4.2. Fin Whale (*Balaenoptera physalus*)

4.2.1. ESA Status

North Pacific fin whales were listed as endangered under the Endangered Species Conservation Act in 1970 and the ESA in 1973 and received full protection from commercial whaling in 1976 under the International Whaling Commission. Between 1925 and 1975, nearly 48,000 fin whales were harvested in the North Pacific (Chapman 1976). No critical habitat has been designated for the North Pacific fin whale, although a final recovery plan was published on July 30, 2010.

4.2.2. Biological Status

4.2.2.1. Abundance and Trends

Prior to commercial whaling, an estimated 25,000 to 27,000 fin whales seasonally inhabited the eastern North Pacific (Ohsuma and Wada 1974). By 1974, this stock was thought to have been reduced to between 38 percent and 50 percent of the original population (Rice 1974, Chapman 1976), although the methods used to estimate the decline may not be reliable (Barlow et al. 1994). Because this species occurs both in shelf edge and pelagic waters of the North Pacific, much of the population occurs outside nearshore marine mammal survey areas. Survey results from Moore et al. (2002) and Zerbini et al. (2006) were combined by Muto et al. (2018) to produce the current population estimate of 5,700 animals for western Alaskan waters (although the data are dated and does not include the full Alaskan range for this species). Zerbini et al. (2006) also estimated that this Northeast Pacific stock has increased at an annual rate of 4.8 percent since 1987.

4.2.2.2. Distribution and Habitat Use

Fin whales are cosmopolitan in their distribution in that they are found in all the oceans of the world, including polar regions, although they are rare in the tropics and the Arctic Ocean. They are found in both pelagic and shelf waters, and especially use shelf edge upwelling and mixing zones. The migratory pattern of eastern North Pacific fin whales is not fully understood, although they are found in Alaska during summer (Mizroch et al. 2009) and off California all year (Clapham et al. 1997).

4.2.2.3. Feeding and Prey Selection

Fin whales feed primarily on krill and schooling fish such as anchovies, Pacific herring (*Clupea pallasii*), and walleye pollock (*Theragra chalcogramma*) (Rice 1963, Clapham et al. 1997). Euphausiids dominated the prey of fin whales taken from British Columbia whaling stations in the 1960s (Flinn et al. 2002).

4.2.2.4. Reproduction

It is assumed that North Pacific fin whales become sexually mature at about 10 years of age, although there is evidence that those in heavily exploited populations can mature in as little as 6 years (Gambell 1985, Ohsumi 1986). The calving interval may also vary depending on exploitation, with heavily hunted populations having intervals closer to 2 years (Christensen et al. 1992) and unhunted populations closer to 3 years (Agler et al. 1993).

4.2.2.5. Natural Mortality

There is little information on natural mortality. It is assumed that they are occasionally attacked by killer whales, but there is little evidence to confirm this.

4.2.2.6. Threats

NMFS identified 11 potential world-wide threats to fin whale recovery (NMFS 2010), with three that were deemed relatively important to recovery (medium or greater impact): ship strike, direct harvest, and climate change. The ship strike database maintained by NMFS (Jensen and Silber 2004) show fin whales to be the species most likely to be struck by a ship largely because of their prevalence near commercial shipping lanes. Direct harvest is currently not a recognized threat in the North Pacific, and while climate change is a global concern, exactly how it could affect North Pacific populations of fin whales is unknown.

4.2.2.7. Acoustical Ecology

There is no direct information about the hearing abilities of fin whales, but Southall et al. (2007) estimated the hearing range of low frequency cetaceans to extend from approximately 7 Hz to 22 kHz based the inner ear morphology of other baleen whales. Baleen whale calls, especially fin whale calls (especially known for their characteristic 20 Hz moans), are also predominantly at low frequencies, mainly below 1 kHz

(Richardson et al. 1995), and their hearing is presumed good at corresponding frequencies. Thus, the auditory system of baleen whales is almost certainly more sensitive to low-frequency sounds than that of the small-to-moderate-sized tooth whales.

4.2.3. Species Use of the Action Area

Fin whales are rarely observed in Cook Inlet and most sightings occur near the mouth of the inlet. The NMFS 1993-2016 beluga whale survey database contains 10 fin whale records (Figure 11). A single whale was observed between Anchor Point and Homer, and another in mid-inlet west of Homer. The remaining eight records are from south of the Action Area at the very mouth of the inlet. None were observed by ABR (2018 survey) or Owl Ridge (2014). It is possible, but unexpected, that fin whales would be encountered during planned PLP activity in lower Cook Inlet.

4.3. Beluga Whale – Cook Inlet Stock (*Delphinapterus leucas*)

4.3.1. ESA Status

The isolated Cook Inlet stock of the beluga whale was listed under the ESA as endangered in 2008 after declining from about 1,300 animals in 1979 (Calkins 1989) to an estimated 278 animals in 2005 (Muto et al. 2018). Subsistence harvest best explains the observed decline as approximately 10–15 percent of the stock was removed annually between 1994 and 1998. A conservation plan was finalized in 2008 and critical habitat was designated in 2011 (Figure 12). NMFS finalized the Recovery Plan for Cook Inlet beluga whales in 2016 (NMFS 2016).

4.3.2. Biological Status

4.3.2.1. Abundance and Trends

The current abundance estimate (based on the 2016 survey) for the Cook Inlet stock of beluga whale is 327 individuals (Muto et al. 2018). Since 2006, the population has continued to decline at a rate of about 0.5 percent annually (Muto et al. 2018).

4.3.2.2. Distribution and Habitat Use

Prior to the decline, this DPS was believed to range throughout Cook Inlet and occasionally into Prince William Sound and Yakutat (Nemeth et al. 2007). However, the range has contracted coincident with the population reduction (Speckman and Piatt 2000, Rugh et al. 2010), with most of the population inhabiting the Susitna Delta in June, compared to only half the population in the past. During summer and fall, beluga whales are concentrated near the Susitna River mouth, Knik Arm, Turnagain Arm, and Chickaloon Bay (Nemeth et al. 2007). Critical Habitat Area 1 (Figure 12) reflects this summer distribution. Historically, beluga whales were recorded in lower Cook Inlet during June and July, but only three whales have been sighted in the lower inlet during NMFS summer biannual aerial surveys since 1996 (Sheldon et al. 2017).

During winter, beluga whales concentrate in deeper waters in the mid-inlet to Kalgin Island, and in shallow water along the west shore of Cook Inlet to Kamishak Bay (Critical Habitat Area 2; Figure 12). Some whales may also winter in and near Kachemak Bay. However, beluga whale tagging studies conducted from

1999 to 2003 found that only a few whales explored waters as far south as Chinitna Bay (Hobbs et al. 2005). Kamishak Bay may no longer be important to beluga whales regardless of season.

4.3.2.3. Feeding and Prey Selection

In the late spring and summer, Cook Inlet belugas concentrate in river mouths of upper Cook Inlet where they feed upon seasonal runs of eulachon (Hobbs et al. 2006) and salmon (Moore et al. 2000). During the remaining part of the year they feed more on cod, sculpins, and flounders (NMFS 2008b).

4.3.2.4. Reproduction

Belugas become sexually mature at between 8 and 13 years of age (Burns and Seaman 1986). Gestation is 14 to 14.5 months (NMFS 2008a), and calving interval is 2 to 3 years (Sergeant 1973). Pregnancy rates are highest for the 12 to 21 age class (Burns and Seaman 1986). Published annual reproductive rates have ranged between 0.08 and 0.14 (NMFS 2008a). In Cook Inlet, most calving is thought to occur from mid-May to July (Calkins 1983).

4.3.2.5. Natural Mortality

Natural mortality includes stranding due to entrapment in shallow water from receding tides, and killer whale predation. However, most tidal strandings do not involve mortalities (Muto et al. 2018). Only four killer whale predation events were recorded between 1999 and 2008 (Shelden et al. 2003, Vos and Shelden 2005, Hobbs and Shelden 2008), and not all attacks were fatal.

4.3.2.6. Threats

The Cook Inlet beluga whale recovery plan (NMFS 2016), identified ten types of potential threats to recovery of the stock, three of which had a high level of relative concern: catastrophic events, cumulative effects of multiple stressors, and noise. Catastrophic events include a major oil spill, climate change, earthquakes, volcano eruptions, disease outbreaks, lethal mass strandings, and failure of key salmon runs. Because the Cook Inlet stock is a relatively small and isolated population living in a both geologically dynamic landscape coupled with offshore oil and gas activity, its vulnerability to these threats is compounded. With the presence of Anchorage, the largest city in the state, human activity within Cook Inlet is high. Cumulative effects from multiple sublethal stressors can lead to health concerns of both individuals and populations, leading to the inability of the population to recover. These stressors include exposure to harmful chemical pollutants from runoff or vapors, with jet fuel vapors and spill runoff a specifically recognized threat in Cook Inlet given the number of airports located around the inlet. Pesticide runoff is also a recognized threat but use of pesticides is not high in Alaska. Cook Inlet is naturally noisy due to currents, rivers, and sea ice dynamics. While beluga whales have evolved to live in such a noisy environment, it may limit their “communication space” and could be compromised by anthropogenic noise sources. NMFS (2016) ordered 16 anthropogenic noise sources in Cook Inlet from highest to lowest threat to recovery based on intensity, frequency (tonal range), duration, and frequency of occurrence. Tug boat noise topped the list and pile driving noise was listed at number 4, both activities proposed for this project. However, pipeline laying was last on the list.

4.3.2.7. Acoustical Ecology

Auditory thresholds for beluga whales have been described at between 2 and 130 kHz (Finneran et al. 2005), with maximum sensitivity between 10 and 70 kHz (Wartzok and Ketten 1999). Odontocetes hear and communicate at frequencies well above the frequencies of pile driving, suction dredging, and ship propellers/thrusters (Wartzok and Ketten 1999). Beluga whales have a well-developed and well-documented sense of hearing. White et al. (1978) measured the hearing of two belugas whales and described hearing sensitivity between 1 kHz and 130 kHz, with best hearing between 30 kHz to 50 kHz. Awbrey et al. (1988) examined their hearing in octave steps between 125 Hz and 8 kHz, with average hearing thresholds of 121 dB re1 μPa at 125 Hz and 65 dB re 1 μPa at 8 kHz. Johnson et al. (1989) further examined beluga hearing at low frequencies, establishing that the beluga whale hearing threshold at 40 Hz was 140 dB re 1 μPa. Ridgway et al (2001) measured hearing thresholds at various depths down to 300 m at frequencies between 500 Hz and 100 kHz. Beluga whales showed unchanged hearing sensitivity at this depth. Lastly, Finneran et al. (2005) measured the hearing of two belugas, describing their auditory thresholds between 2 kHz and 130 kHz. In summary, these studies indicate that beluga whales hear from approximately 40 Hz to 130 kHz, with maximum sensitivity from approximately 30 kHz to 50 kHz. It is important to note that these audiograms represent the best hearing of belugas, measured in very quiet conditions. These quiet conditions are rarely present in the wild, where high levels of ambient sound may exist.

4.3.3. Species Use of the Action Area

In recent decades, Cook Inlet beluga whales have been largely confined year-round to upper Cook Inlet waters (Rugh et al. 2010, Shelden et al. 2017). Only occasionally are these whales observed in the lower Cook Inlet, and there have been no sightings of beluga whales within Kamishak Bay within recent years (Rugh et al. 2010, Shelden et al. 2017).

4.3.4. Critical Habitat

A portion of the Action Area (Kamishak Bay) falls within Designated Critical Habitat Area 2, or portions of Cook Inlet where beluga whales typically occur during the fall and winter, although, as mentioned above, beluga whale use of Area 2 habitat as far south as the Action Area has not occurred in recent years (Rugh et al. 2010, Shelden et al. 2017).

In the Final Rule (76 FR 20180), published in 2011, NMFS identified five primary constituent elements (PCEs) essential for conservation of the species and that require special management considerations or protection. They are:

- PCE # 1 - Intertidal and subtidal waters of Cook Inlet with depths <30 feet (9.1 m) Mean Lower Low Water and within 5 mi (8 km) of high and medium flow accumulation anadromous fish streams
- PCE # 2 - Primary prey species consisting of four (4) species of Pacific salmon (Chinook, sockeye, chum, and coho), Pacific eulachon, Pacific cod, walleye pollock, saffron cod, and yellowfin sole
- PCE # 3 - The absence of toxins or other agents of a type or amount harmful to beluga whales
- PCE # 4 - Unrestricted passage within or between the critical habitat areas

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

The potential effect the proposed project might have on these PCEs is difficult to discern given the current lack of beluga whale use in the Action Area, and the construction activity occurring during the summer months when beluga whale populations are concentrated in northern Cook Inlet.

4.4. Steller Sea Lion (*Eumetopias jubatus*)

4.4.1. ESA Status

Steller sea lions are found in all continental shelf waters from central California, north to Alaska, through the Aleutian Islands to Kamchatka Peninsula, then south to northern Japan. Due to substantial population declines in the western portion of its range, the Steller sea lion was first listed as threatened under the ESA in 1990, with critical habitat designated in 1993 (NMFS 2008b). In 1997, NMFS identified two DPSs, a Western and an Eastern, and reclassified the Western DPS as endangered based on persisting decline (NMFS 2008b). The Western DPS (which inhabits Cook Inlet) declined more than 80 percent between the late 1960s and 2000 at consistently monitored rookeries and haulout sites. Critical habitat designated in 1993 (50 Code of Federal Regulation [CFR] 45269) includes a 20 nautical mile buffer around all major haulouts and rookeries, and three large offshore foraging areas, within the area used by the Western DPS (Figure 13). A recovery plan was developed in 2008.

4.4.2. Biological Status

4.4.2.1. Abundance and Trends

The minimum abundance estimate for the Western DPS of Steller sea lion is 54,267 animals, which is based on pup and non-pup estimates in Alaska in 2017 (Muto et al. 2018). This is down from a 1950s population estimated for Alaska alone at 140,000 (Merrick *et al*. 1987). Strong evidence suggests that pup and non-pup counts of this DPS were at their lowest levels in 2002 and have increased at 1.78 percent and 2.14 percent, respectively, between 2002 and 2017 (Muto et al. 2018). However, the data also show strong regional differences across the range in Alaska, with positive trends in the Gulf of Alaska and eastern Bering Sea east of Samalga Pass and generally negative trends to the west in the Aleutian Islands (Muto et al. 2018).

In contrast, the Eastern DPS has increased at a 3 percent annual rate between the 1970s and 2002. Declines in the small number of Steller sea lions that inhabit central California have been offset by modest increases in northern California and Oregon, and more dramatic increases in Southeast Alaska and British Columbia. The current minimum population estimate is 41,638 (Muto et al. 2018).

4.4.2.2. Distribution and Habitat Use

Steller sea lions are found in all continental shelf waters from central California, north to Alaska, through the Aleutian Islands to Kamchatka Peninsula, then south to northern Japan. Major haulout sites and rookeries nearest to the Action Area are located approximately 30 mi (48 km) (Table 3) from Pebble's proposed marine activities and occur near the mouth of Cook Inlet at the Barren Islands and off the southern tip of the Kenai Peninsula. There are no major haulouts within Cook Inlet.

Table 3: Distances of Steller sea lion rookeries and haulout sites to the Action Area.

Rookery/Haulout	Distance mi (km)
Ushagat Island	29.9 (48)
Sud Island	34.6 (56)
Nagahut Rocks	33.3 (53)

During summer Steller sea lions feed mostly over the continental shelf and shelf edge. Females attending pups forage within 20 nautical miles of breeding rookeries (Merrick and Loughlin 1997), which is the basis for designated critical habitat around rookeries and major haulout sites. During winter, some of these sea lions may venture far out to sea in pursuit of prey (NMFS 2008b).

4.4.2.3. Feeding and Prey Selection

Steller sea lions are generalists, feeding on a wide variety of fish and cephalopods (Calkins and Goodwin 1988). In Alaska and British Columbia, schooling fish such as Pacific cod (*Gadus macrocephalus*), Pacific hake (*Merluccius productus*), walleye pollock, Pacific herring, Pacific sand lance (*Ammodytes hexapterus*), squid, and salmon are of great importance, although rockfish are also important (Calkins and Goodwin 1988, Calkins 1998). Small schooling fish and salmon are eaten almost exclusively during summer, cod during winter, and pollock year-round (Merrick and Calkins 1996, NMFS 2008c).

4.4.2.4. Reproduction

Female Steller sea lions reach sexual maturity at 3 to 6 years of age and can continue to breed into their early twenties (Mathisen et al. 1962, Pitcher and Calkins 1981). Males are sexually mature at 3 to 7 years of age but are not physically mature enough to challenge for breeding rights until about 10 years of age (Thorsteinson and Lensink 1962, Pitcher and Calkins 1981, Raum-Suryan et al. 2002). Sexually mature females are capable of pupping annually, and studies in the 1970s and 1980s found early gestation pregnancy rates of 97 percent (NMFS 2008c). However, during periods consistent with nutritional stress, pregnancy will be terminated early (intrauterine mortality or premature birthing) (Calkins and Goodwin 1988). During the decline of the Western DPS population in the 1970s and 1980s, pregnancy rates during late-term gestation dropped to between 55–67 percent (NMFS 2008c), and for lactating females, the late-term pregnancy rate was even lower suggesting that nursing compounds the energetic stress of reproduction during periods of low food availability. Females with better body condition were more likely to maintain pregnancy (NMFS 2008b).

4.4.2.5. Natural Mortality

About 20 percent of a stable Steller sea lion population dies annually from natural mortality including trampling, disease, senescence, and killer whale predation (NMFS 2008b). Killer whales have been implicated as a possible factor for the observed sea lion decline, or at least as a limit preventing recovery. Williams et al. (2004) explained that the foraging demands of even a relatively few killer whales could account for high sea lion losses. However, other studies have shown that sea lions are a relatively small component of the diet of mammal-eating killer whales for the Western DPS (6 to 22 percent; Wade et al. 2007), and that killer whales using Kenai Fjords annually ate from 3 to 7 percent of the local sea lion population, or only about a quarter of the annual natural mortality (Maniscalco et al. 2007). A decline in the carrying capacity resulting in nutritional stress and lower reproduction rates remains the most viable explanation for the dramatic decline of the Western DPS of Steller sea lions from the 1970s to the 2000s (NMFS 2008b).

4.4.2.6. Threats

Potential threats most likely to result in direct human-caused mortality or serious injury of this stock include subsistence harvest, entanglement in fishing gear and marine debris, incidental take, illegal shooting, and disturbance. The total estimated annual level of human-caused mortality and serious injury for Western U.S. Steller sea lions in 2012-2016 is 252 sea lions (Muto et al. 2018). This total includes 203 Steller sea lions in the Alaska Native subsistence harvest and 40 in U.S. commercial fisheries. Estimates of entanglement in fishing gear and marine debris are based solely on stranding reports in areas west of 144°W longitude and may underestimate the entanglement of western stock animals that travel to parts of Southeast Alaska (Muto et al. 2018). Disturbance of Steller sea lion haulouts and rookeries can potentially cause disruption of reproduction, stampeding, or increased exposure to predation by marine predators (NMFS 2008b).

4.4.2.7. Acoustical Ecology

Steller sea lion's hearing sensitivity is like that of other otariids. Steller sea lion in-air hearing ability ranges from approximately 0.25-30 kHz; however, hearing of one individual was found to be most sensitive to noise from 5-14.1 kHz (Muslow and Reichmuth 2010). Underwater, best hearing range of a Steller sea lion has been measured at from 1-16 kHz in a male individual and maximum hearing sensitivity of a female individual at 25 kHz, showing a marked sexual dimorphism (though hearing characteristics may also vary based on age or size of the individual). Generalized hearing ranges from 60 Hz to 39 kHz (NMFS 2018). Steller sea lions use both aerial and underwater vocalizations during breeding, territorial disputes, and rearing of pups (Kastelein et al. 2005).

4.4.3. Species Use of the Action Area

There is no Steller sea lion critical habitat within the Action Area, although the area falls within the range of the endangered Western DPS. Major haulout sites relative to PLP's proposed marine activities occur near the mouth of Cook Inlet at the Barren Islands and off the southern tip of the Kenai Peninsula. Table 3 shows the distance from the Action Area to the nearest rookeries or major haulout sites shown in Figure 13. There are no major haulouts within Cook Inlet, although NMFS may soon recognize Shaw Island on the eastern edge of Kamishak Bay as a major haulout site, as 70 sea lions were recorded near there in 2016 during beluga whale surveys conducted by NMFS (Shelden et al. 2017). Shaw Island is 32 mi (52 km) from the proposed Amakdedori Port location and 13 mi (21 km) from the closest approach of the Action Area. Given the number of years of survey (1993-2016) conducted by NMFS in Cook Inlet, relatively low numbers of Steller sea lions have been recorded in Cook Inlet and most south of the Action Area (Figure 14). However, ABR did record several sea lions within Kamishak Bay during incidental surveys conducted in 2018 (Figure 15), and their seasonal presence in the Action Area might be higher than the limited survey data suggest.

5. CONSEQUENCES OF PROPOSED ACTION

Construction activities proposed by PLP in Cook Inlet have the potential to impact listed humpback whales, fin whales, beluga whales, and Steller sea lions, and critical habitat via:

- Disturbance from construction of the Amakdedori Port
- Construction vessel strike of large whales
- Whale entanglement in anchor lines
- Incidental spills of petroleum lubricants and fuels from fueling and operation of construction equipment
- Foraging habitat (and prey) loss from the Amakdedori Port causeway and wharf construction

These potential stressors – disturbance, vessel strike, incidental spill, foraging habitat loss – are addressed below.

5.1. Noise Disturbance

Relative to marine mammals, man-made noise introduced into the marine environment can result in impaired hearing, disturbance of normal behaviors (e.g., feeding, resting, social interactions), masking calls from conspecifics, disruption of echolocation capabilities, and masking sounds generated by approaching predators. Behavioral effects may be incurred at ranges of many miles, and hearing impairment may occur at close range (Madsen et al. 2006). Behavioral reactions may include avoidance of, or flight from, the sound source and its immediate surroundings, disruption of feeding behavior, interruption of vocal activity, and modification of vocal patterns (Watkins and Schevill 1975, Malme et al. 1984, Bowles et al. 1994, Mate et al. 1994). Long-term exposure can lead to fitness-reducing stress levels, and in some cases, physical damage leading to death can occur (e.g., Balcomb and Claridge 2001).

The hearing of baleen whales remains unmeasured, but anatomical analyses suggest they are low-frequency specialists with good sensitivity at less than 2 kHz (Wartzok and Ketten 1999). Odontocetes (toothed whales), however, are high-frequency specialists. For example, beluga have their best hearing sensitivity between 30 and 80 kHz (Finneran et al. 2005). Most pinnipeds have peak sensitivities between 1 and 20 kHz (NRC 2003), with phocids such as ringed and harbor seals peaking at over 10 kHz and showing good sensitivity to approximately 30 kHz (Wartzok and Ketten 1999). Also, pinniped sensitivity to underwater noise relates to their evolutionary adaptation to the underwater environment. Kastak and Schusterman (1998) found that northern elephant seals, which forage at great depths and spend prolonged periods underwater, have better underwater hearing sensitivity than in-air, while sea lions, which spend considerably more time at the surface or hauled out, exhibited the reverse.

5.1.1. Threshold Shift

When exposed to intense sounds, the mammalian ear will protect itself by decreasing its level of sensitivity (shifting the threshold) to these sounds. Stereocilia are the sound sensing organelles of the middle and inner ear. They are the “hairs” of the specialized cells that convert sound wave energy to electrical signals. When sound intensity is low, the hairs will bend towards the incoming waves, thereby increasing sensitivity. If the sound intensity is high, the hairs will bend away to reduce wave energy damage to the sensitive organelles, which includes a reduction in sensitivity. If the sound levels are loud enough to damage the hairs, the reduction in sensitivity will remain, resulting in a shift in hearing threshold. These threshold shifts can be temporary (temporary threshold shift [TTS]) or permanent (permanent threshold shift [PTS]) (Weilgart 2007) depending on the recovery ability of the stereocilia and connecting hair cells. Over-activation of hair cells can lead to fatigue or damage that remains until cells are repaired or replaced.

Exposure to intense impulsive noises can disrupt and damage hearing mechanisms in mammals, leading to a threshold shift. However, these threshold shifts are generally temporary (TTS), as the hair cells have some ability to recover between and after the intermittent sound pulses. The only impulsive noise of concern for PLP's project is the limited impact pile driving associated with construction of Amakdedori Port.

Long-term exposure to continuous noise, even noise of moderate intensity, can lead to a PTS. This is because the continuous wave energy does not allow hair cells to recover. If the exposure is long enough, the ability to replace damaged hair cells after the exposure has ceased is also reduced, and the threshold shift becomes permanent.

The primary underwater noise associated with the port construction is the continuous noise from vibratory pile driving. Continuous underwater noise also emanates from anchor-handling vessels during laying of the gas pipeline. However, NMFS has recently determined that vessel noise impacts from the operation of tug thrusters and propellers are discountable (83 FR 7655). Noise associated with placement of fill during wharf construction is a continuous source occurring in short, intermittent periods. Harassment impacts to cetaceans and pinnipeds are questionable. Colluch et al. (2016) recently evaluated the impacts of construction of a gas-pipeline off the coast of Ireland, which included backfilling and rock placement, with results suggesting that while for some species (harbor porpoise and minke whale) there was short-term displacement, "there were no long-term populations effects as a result of construction-related activity or vessel traffic."

5.1.2. Masking

Masking occurs when louder noises interfere with marine mammal vocalizations or their ability to hear natural sounds in the environment (Richardson et al. 1995), which limit their ability to communicate, detect prey, or avoid predation or other natural hazards. Masking is of particular concern with baleen whales because low-frequency anthropogenic noises, such as typical construction noises, overlap with their communication frequencies. Some baleen whales have adjusted their communication frequencies, intensity, and call rate to limit masking effects from shipping noises (Watkins 1986, Scheifele et al. 2005, Holt et al. 2009, McDonald et al. 2009, Melcón et al. 2012).

PLP's planned pipeline construction, port construction, and vessel traffic will have some limited, additive effect to the overall anthropogenic noise budget.

Most auditory studies on pinnipeds to date indicate that pinnipeds can hear underwater sound signals (such as higher frequency calls) in noisy (low frequency) environments, a possible adaption to the noisy nearshore environment (due to wind, waves, and biologics) they inhabit (Southall et al. 2000). Southall et al. (2000) found northern elephant seals, harbor seals, and California sea lions lack specializations for detecting low-frequency tonal sounds in noise, but rather were more specialized for hearing broadband noises associated with schooling prey.

The extent of masking associated with PLP’s marine program is a function of the duration a noise source is within hearing proximity of a marine mammal, and the additive noise from PLP’s activity to overall anthropogenic noise levels in lower Cook Inlet. Working with killer whales, Crystal et al. (2011) found masking effects from vessels are eliminated at speeds less than 10 knots (kt) (18.5 km/hr). Whether this would apply also to other odontocetes such as harbor porpoises is unknown. However, odontocetes compensate for masking effects from vessel noise by increasing call intensity (Lombard effect), although the fitness implications of doing so is unknown. Given the ability for pinnipeds to hear well in noisy backgrounds (Southall et al. 2000), combined with the short duration of exposure from a moving vessel, masking concerns due to vessel noise are not particularly significant for these marine mammals.

Masking is of greater concern with large baleen whales. Although masking might increase the risk of large baleen whales to killer whale predation, the increased risk is probably slight and minimal given the overall low predation risk. Communication masking is the primary issue, given the rate at which large baleen whales normally communicate. Communication masking is a function of the loss of communication space because of noise relative to the available communication space during quiet conditions (Clark et al. 2009). The size of communication space for a given species, in turn, is a function of call frequency range and call intensity. Clark et al. (2009) studied potential communication space loss from vessel traffic for singing fin and humpback whales and calling North Atlantic right whales. They found that for the source band (18 to 28 Hz) in which fin whales sing, source levels from a passing ship (181 dB) were essentially the same as the source level from the whale (180 dB), while for humpback source bands (224 to 708 Hz), ship source levels (167 dB) were much lower than whale source levels (170 dB). Thus, for both species there was little loss of communication space from the passing ship. The vessel noise associated with Pebble’s pipeline construction project will include limited operation of small tugs traveling at speeds less than 10 kt (18.5 km/hr), a great difference from the large commercial ships that have raised concern in the past. Finally, NMFS has recently published that harassment associated with construction vessel noise (83 FR 7655) is discountable.

5.1.3. Chronic Disturbance

Continued exposure to low levels of noise and disturbance can lead to chronic stress, potentially further leading to stress-related responses such as immune system suppression, reproductive failure, slowed growth, and an overall decline in fitness. Chronic stress is exposure to stressors that last for days or longer and does not apply to a passing vessel. However, disturbance noise from a passing vessel (acute stress) can add to the overall stress budget (known as the allostatic load; Romero et al. 2009) of an individual marine mammal contributing to general distress and deleterious effects. Additional vessel passes would, of course, contribute further to the stress load.

In general, baleen whales seem less tolerant of continuous noise (Richardson and Malme 1993) and, for example, often detour around stationary drilling activity when received levels are as low as 119 dB re 1 μPa (rms) (Malme et al. 1983, Richardson et al. 1985, 1990). These studies are the basis for the threshold for harassment take from continuous noise defined at 120 dB re 1 μPa (rms). Humpback whales have been especially responsive to fast moving vessels (Richardson et al. 1995), and often react with aerial behaviors such as breaching or tail/flipper slapping (Jurasz and Jurasz 1979). Humpback whales have also shown a general avoidance reaction at distances from 1.2 to 2.5 mi (2 to 4 km) of cruise ships and tankers (Baker et al. 1982, 1983), although they have displayed no reactions at distances to 0.5 mi (800 m) when feeding

(Watkins et al. 1981, Krieger and Wing 1986), and temporarily disturbed whales often remain in the area despite the presence of vessels (Baker et al. 1988, 1992). Odontocetes are probably less sensitive to acoustical disturbance from vessels because of their lower sensitivity to the low frequency noise generated by cavitating propellers. However, the presence of oceanic tug/barges could be disturbing to odontocetes when in proximity, such as the coincidence of beluga whales and barging in confined nearshore summer breeding or feeding habitat in Cook Inlet. Williams et al. (2009) found that Southern Resident killer whales travel greater distances in the presence of vessels, presumably to avoid these vessels, leading to increased energy expenditure and reduced fitness.

Most information on the reaction of sea lions to boats relate to disturbance of hauled out animals. None of the proposed barging routes will come within disturbance distance to sea lion rookeries or haulouts. There is little information on the reaction of these pinnipeds to ships while in the water other than some anecdotal information that sea lions are often attracted to boats (Richardson et al. 1995).

PLP's construction (e.g., pile driving) will have some additive effect to the overall anthropogenic noise budget, especially since there is limited anthropogenic noise within Kamishak Bay to begin with (as compared to other locations in Cook Inlet).

5.1.4. Relevance to the Pebble Project

Intermittent noise from pile driving will occur over 90 days during port construction. The impacts are limited to a radius of a 11.3 mi (18.2 km) and will not occur in the winter when beluga whales are potentially present. Impacts would be temporary for a small number of humpback whales, fin whales, and Steller's sea lions, and will be mitigated by monitoring shut down safety zones to avoid Level A injury take (see Section 6.2).

The primary underwater noise associated with pipeline construction emanates from the small tugs when handling the barge anchors. However, while thruster and propeller use by these tugs does produce noise levels above Level B thresholds, NMFS has recently published (see 83 FR 7655) that these noise levels are similar to those of transiting vessels, rarely result in marine mammal response, and the likelihood of thruster use resulting in harassment take to be low to the point of discountable.

5.2. Vessel Strike

Collisions with marine vessels have been implicated in the deaths of marine mammals (Goldstein et al. 1999, Laist et al. 2001, Jensen and Silber 2004, Panigada et al. 2006, Van Waerebeek et al. 2007, Berman-Kowalewski et al. 2010). Whale mortality from ship strike is usually a result of blunt force injury from striking the ship bow (blunt trauma), or lethal wounding from propeller cuts (sharp trauma) (Moore et al. 2013). Worldwide (Laist et al. 2001, Jensen and Silber 2004) and in waters off the state of Washington (Douglas et al. 2008), fin whales are the most common cetacean killed by vessels. This may be a function of a greater population size or higher density in shipping lanes as opposed to a greater biological vulnerability (Douglas et al. 2008). Douglas et al. (2008) also noted that fin whales were more susceptible to blunt trauma from a bow strike, while gray whales were more likely to be injured by sharp trauma from a propeller strike. Neilson et al. (2012) documented 108 ship strikes in Alaska from 1978 to 2011 and found the clear majority to involve humpback whales in Southeast Alaska. All these records indicate that baleen whales are more susceptible to vessel strike than toothed whales. Of the 292 large whale ship strikes recorded by NMFS between 1975 and 2002 (Jensen and Silber 2004), only 17 (6 percent) involved sperm whales and only one a killer whale. Also, there are no records of lethal vessel strikes involving Cook Inlet beluga whales, although Kaplan et al. (2009) did record what appeared to be marks from a small propeller on at least two whales during photo-identification studies conducted from 2005 to 2008.

Vessel speed is the primary factor in the probability of a vessel strike occurring as well as the probability of the strike being lethal (Jensen and Silber 2004, Vanderlaan and Taggart 2007). The large whale ship strike database (Jensen and Silber 2004) indicates that the number of vessel strikes by vessels traveling at less than 10 kt (18.5 km/hr) is very low relative to the number of vessels normally traveling at those speeds. Vanderlaan and Taggart (2007) analyzed the ship strike database (Jensen and Silber 2004) and found that the probability of a strike actually being lethal (as opposed to survivable) was also low (<20 percent) for strikes at speeds less than 8 kt (15 km/hr), but high (>50 percent) at speeds greater than 12 kt (22 km/hr). This and additional information was used to develop the 10 kt (18.5 km/hr) restriction now enforced in North Atlantic right whale (NMFS 2008c) habitat off New England. Conn and Silber (2013) estimated that implementation of this vessel speed rule reduced the risk of vessel collisions with right whales by 80 to 90 percent. Laist et al. (2014) evaluated the effectiveness of the restriction five years after it was implemented and concluded that it was statistically significant in reducing whale deaths. The number of whale deaths attributed to ship strike within the restricted area reduced from 0.72 whales killed per year during the 18 years prior to the rule to zero during the five years after the restriction was implemented.

Pinnipeds are far less susceptible to vessel strike, probably because of their visual awareness both above and below water, and their quick maneuverability. Of 6,197 strandings of six species of pinnipeds in central California between 1986 and 1998, only five exhibited vessel-strike damage.

5.2.1. Relevance to the Pebble Project

Vessel strikes are most likely to occur where large whale concentration areas overlap with shipping traffic. For example, Neilson et al. (2012) compiled collision records from Alaska and found that while two collisions were reported from Cook Inlet, the majority (76 percent) were from Southeast Alaska where constricted waterways are more likely to place whales within shipping routes. Most of the remaining collisions occurred in Prince William Sound and Resurrection Bay where, again, travel lanes are constricted.

Construction support tugboats, pipelaying vessels, and construction barges offer very little risk of collision to marine mammals. First, tugs with barges in tow inherently travel at less than 10 kt (18.5 km/hr), the threshold above which vessel collision is of greatest concern (Jensen and Silber 2004, Silber and Bettridge 2012). Once in the construction area, tug traffic will be limited to occasional maneuvering of barges. Any and all other vessel traffic associated with the project will be limited to travel speeds less than 10 kt (18.5 km/hr) to protect sea otter pups, a measure that will also protect cetaceans and pinnipeds. Further, many of the tugboats used in the towing operations will have their propellers recessed into the vessel hull to prevent bottom-strike in shallow waters and inside protective nozzles. These configurations reduce or eliminate the risk of sharp trauma from contact with the moving propeller blades. The remaining risk, albeit low, is from a potential collision with the bow of a towing (pulling) vessel passing through marine mammal concentration areas. However, ocean tugs are also designed to push up against other vessels and do not generally have sharp, bulbous bows. They may push aside a marine animal rather than strike it with full blunt force, depending on strike angle (Silber et al. 2010).

Construction vessels pose little risk to sea lions, as they appear maneuverable and aware enough to easily avoid vessel contact (Lawson and Lesage 2013). Vessel collision risk to highly maneuverable Cook Inlet beluga whales is probably also very low (especially given the lack of seasonal overlap); however, any mortality for these extremely small populations poses a population level risk. Still, none of the eighty-nine whale/ship collisions reported by Neilson et al. (2012) involved a barge.

5.3. Entanglement

Large whales, especially humpback whales, are susceptible to entanglement in fishing gear both in the Gulf of Maine (Robbins and Mattila 2001) and Southeast Alaska (Neilson et al. 2004), and both humpback and fin whales have been reported to interact with vessel moorings and anchor chains, sometimes with lethal consequences (Benjamins et al. 2014). Neilson et al. (2004) found that over half of the humpback whales investigated bore scars from fishing gear entanglement, and in 2011, a fin whale became enwrapped in an anchor cable in Uyak Bay (Kodiak Island) and eventually drowned (Benjamins et al. 2014).

5.3.1. Relevance to the Pebble Project

The project will not involve the use of fishing gear, but two spread anchor mooring systems at the lightering locations and two lighted navigational buoys, which use anchor chains, will be placed in the Action Area and might pose an entanglement risk to large whales. In addition, the pipeline barge will be held in place using a spread of anchor cables. However, all anchor chains and cable will be taught and non-kinking.

5.4. Incidental Spill

Incidental spills, also called operational spills, resulting from the fueling and operation of construction equipment can be safely controlled at the time of release by the personnel who are present, do not have the potential to become an emergency within a short time, and are of limited quantity, exposure, and potential toxicity. They may include incidental discharges such as bilge water that might contain oils or oily detergents from deck washdown operations; releases of small volumes of hydraulic fluids, motor fuels and oils, and other fluids used in equipment operation. The accumulation of a number of small spills can lead to impaired marine waters.

5.4.1. Relevance to the Pebble Project

PLP and their construction contractors must comply with all laws and regulations related to spill prevention and preparedness or petroleum lubricants and fuel, including 40 CFR part 110, and those related to vessel-to-vessel transfer, including 33 CFR part 144. Construction operations would implement spill prevention control measures, and in the event of a spill would facilitate a rapid response and cleanup operation. Spill prevention measures include design standards, use of established procedures (e.g., fuel transfer procedures), regular equipment inspections and maintenance, and personnel training. They also focus on spill response by requiring pre-staged spill response equipment, pre-identification of sensitive areas, personnel training, and regular spill drills. Agency inspections are also important elements of assuring spill response prevention, preparation and readiness.

Given the required fuel Best Management Practices (BMPs) it is unlikely that an incidental fuel spill would result in the escape and travel of enough fuel to result in any consequential exposure to a listed marine mammal under NMFS jurisdiction. Incidental spills during refueling of construction equipment are not considered a significant risk to listed whales and sea lions.

5.5. Effects to Prey

For the listed species addressed in this assessment, nearly all feed on small schooling fish, shrimp, squid, and zooplankton. All these prey species could become contaminated from spills leading to bioaccumulation or biomagnification of toxins in listed species (Eisler 1987, Almeda et al. 2013a, b), although diesel has a low specific gravity and does not sink; thus, rarely reaches the seafloor. Plankton appears to be particularly sensitive to oil (ITOPF 2014a); however, small schooling fish generally do not live long enough to bioaccumulate large amounts of toxins, and fish are able to metabolize polycyclic aromatic hydrocarbons, the oil contaminant of greatest concern (Eisler 1987). Further, because of its high viscosity, fuel oil is less readily incorporated into live tissue and, thus, is less bioavailable than, for example, crude oil (ITOPF 2014b).

Vessel activity can directly affect plankton, fish eggs, fish larvae, and small fish through hull shear, entrainment through the propulsion system, exposure to turbulence in the propeller wash, and wake stranding (Odom et al. 1992). However, studies have found it difficult to detect vessel-related mortality (Holland 1986, Odom et al. 1992), and have found fish larvae to be relatively resilient. Wake stranding, the depositing of fish onto shore by vessel-induced waves, is a function of wave amplitude, which further is a result of vessel size, vessel draft, vessel speed, and distance of vessel from shore (Bauersfeld 1977). Ackerman (2002) studied salmonid stranding in the lower Columbia River and found that shallow-draft tugs pulling barges produced much smaller wake amplitudes (average of 0.52 ft [0.15 m]) than larger, deep-draft ships (1.7 ft [0.52 m]), and all but one of the observed salmonid strandings were associated with deep-draft ships. The PLP vessel activities are not likely to produce large enough wakes to generate fish stranding, because of the shallow draft of vessels and type of activity.

Controlled laboratory experiments suggest that impact pile driving can cause effects to fish. Effects range from altered behavior and damage to body tissues that could result in death (Halvorsen et al. 2011). Effects on behavior could cause fish to leave sites of biological importance, such as spawning habitat. Physical effects on fishes include loss of hearing and injury to tissues such as barotrauma, which occurs when there is a rapid change in pressure that directly affects the body gases.

However, data on the effects of exposure to such sound on fish in the natural environment is limited (Popper and Hastings 2009, Dahl et al. 2015). In part, this is because field research on the effects of pile driving operations is difficult to accomplish when control over pile-driving exposures does not exist (Halvorsen et al. 2011). In addition, issues exist with the nature of the exposure, such as the number of exposures of individual animals, the intervals between exposures, and the spectrum of the received signal (Popper and Hastings 2009). Consequently, understanding of the effects of sound generated by pile driving on fishes remains challenging (Dahl et al. 2015).

Research with juvenile Chinook salmon suggest physiological effects from pile driving sounds occur when the cumulative Sound Exposure Level (SEL_{cum}) exceeds about 210 dB re 1 μPa2•s (Halvorsen et al. 2011). Their results also indicate the onset of physiological effects depends on the single strike level and the number of strikes. Thus, as the number of strikes increases, physiological risk could be lowered by reducing the single strike level. Finally, Halvorsen et al. (2011) determined that the onset of injuries through exposure to sounds of pile driving occurs at sound exposure levels that are at least 20 dB above the levels that are part of the current interim guidelines used on the U.S. west coast and in other parts of the world. This research suggests that juvenile fish in the vicinity of the proposed impact pile driving could be harmed but given that the planned impact driving is very limited compared to vibratory pile driving (and the likely presence of prey fish is unknown), the potential impacts are not significant at a prey population level.

6. AVOIDANCE AND MINIMIZATION

Avoidance and minimization measures, collectively mitigation measures, are intended to limit or reduce construction-related impacts to listed species or critical habitat. Avoidance is the primary means for limiting impacts to wintering beluga whales as they will not be present during the summer construction period (although there is critical habitat for this species in the Action Area). Relative to other marine mammals the construction elements requiring mitigation include sediment suspension and release during fill placement and pipeline trenching (potential impacts to critical habitat) and noise associated with fill placement and pile driving (direct impacts to individuals).

6.1. Mitigation Measures (Sediment Control)

Construction mitigation measures for this project will follow standard construction practices, including BMPs, to avoid or limit impacts to marine mammals, including: turbidity and silt curtains, clean fill, and testing of fill materials to verify a neutral range of 7.5 to 8.4 pH. In marine waters, this pH range will maximize colonization of marine organisms. Excessively alkaline or acidic fill material will not be used

6.2. Mitigation Measures (Noise)

To mitigate for noise impacts to cetaceans and pinnipeds, PLP will develop and implement a Marine Mammal Monitoring and Mitigation Plan (4MP) in association with an Incidental Harassment Authorization (IHA). The plan will include the use of noise attenuating devices as required, such as bubble curtains, ramp up procedures (soft-start), and establishing both shutdown safety zones (to avoid Level A take) and monitoring zones (to document Level B take) around the pile driving and fill placement activities (and possibly spread anchor mooring system placement should rock drilling be required). The plan will also include employing Protected Species Observers (PSOs) to monitor these zones and initiate activity shutdown as needed to prevent Level A take of cetaceans and pinnipeds. The exact radii of the safety and monitoring zones will be determined during the IHA process. The PSOs will follow an established set of protocols, which apply to species both under USFWS and NMFS jurisdiction, and include:

1. PSOs serving as observers will be in good physical condition and be able to withstand harsh weather conditions for an extended period of time. They must have vision correctable to 20-20.
2. PSOs will have the experience and ability sufficient to conduct field observations and data collection according to assigned protocols.
3. PSOs will have experience or training in field identification of marine mammals and marine mammal behavior. PSOs serving as observers will be able to accurately identify marine mammals in Alaskan waters by species.
4. PSOs must be able to accurately identify and distinguish between species of cetaceans, pinnipeds, and sea otters under field conditions.
5. PSOs serving as observers will have writing skills sufficient to prepare understandable reports of observations and technical skills to complete data entry forms accurately.
6. PSOs will work in shifts lasting no longer than 4 hours with at least a 1-hour break from marine mammal monitoring duties between shifts. PSOs will not perform PSO duties for more than 12 hours in a 24-hour period (to reduce fatigue). Note that during the 1-hour break for a PSO, a crew member can be assigned to be the observer as long as they do not have other duties at that time

and they have received instructions and tools to allow them to make marine mammal observations.

7. PSOs will be positioned such that the entire monitoring zone of activities is visible.
8. PSOs will have the ability to effectively communicate orally, by radio and in person, with project personnel to provide real-time information on marine mammals and will have the ability and authority to order appropriate mitigation responses to avoid takes of all marine mammals.
9. The PSOs will have the following equipment to address their duties:

    a. Range finder
    b. Annotated chart and compass
    c. Inclinometer
    d. Two-way radio communication, or equivalent, with onsite project manager
    e. Appropriate personal protective equipment
    f. Daily tide tables for the project area
    g. Watch or chronometer
    h. Binoculars (7 x 50 or higher magnification) with built-in rangefinder or reticles (rangefinder may be provided separately)
    i. Handheld global positioning system
    j. A copy of the Letter of Concurrence (LOC) and all appendices, printed on waterproof paper and bound
    k. Observation Record forms printed on waterproof paper, or weatherproof electronic device allowing for required PSO data entry

10. PSOs will record observations on data forms or into electronic data sheets, electronic copies of which will be submitted to NMFS in a digital spreadsheet format on a monthly basis.
11. PSOs will have stop-work authority during pile driving, dredging, discharges of fill, or pipelaying in the event a listed-marine mammal is observed in or is determined by the PSO to be likely to enter the monitoring zone.
12. PSOs serving as observers will have no other primary duties beyond watching for, acting on, and reporting events related to marine mammals. For crew members, this mitigation measure only applies during the time the crew member must assume the duties of the PSO due to the absence of a qualified PSO.
13. PSOs will use NMFS-approved Observation Records. Observation Records will be used to record the following:

    a. Date and time that activity and observation efforts begin and end
    b. Weather parameters (e.g., percent cloud cover, percent glare, visibility) and sea state where the Beaufort Wind Force Scale will be used to determine sea-state (https://www.weather.gov/mfl/beaufort)
    c. Numbers of observed marine mammals, along with the date, time, and location of the observation
    d. The predominant sound-producing activities occurring during each marine mammal sighting
    e. Location of marine mammals, distance from observer to the marine mammal, and distance from the predominant sound-producing activity or activities to marine mammals

   f. Whether the presence of marine mammals necessitated the implementation of mitigation measures to avoid acoustic impact, and the duration of time that normal operations were affected by the presence of marine mammals

14. Prior to commencing in-water activities, PSOs will scan waters within the monitoring zones and confirm no listed marine mammals are observed to be present within the monitoring zones for 30 minutes prior to initiation of an in-water activity. If one or more listed marine mammals are observed within the monitoring zones, no in-water activity will begin until the marine mammals exit the monitoring zones of their own accord, and the zones have remained clear of marine mammals for 30 minutes immediately prior to activity.
15. If no listed marine mammals are observed within the monitoring zone for 30 minutes, soft-start procedures will be implemented immediately prior to operational impact or vibratory driving activities to provide a chance for marine mammals to leave the monitoring zone prior to pile driving at operational power. For impact driving, a soft-start is comprised of an initial set of three strikes from the hammer at about 40 percent energy, followed by a 30-second waiting period, then two subsequent three-strike sets with associated 30-second waiting periods at the reduced energy. For vibratory pile driving, a soft-start requires pile driving operators to initiate sound from vibratory hammers for fifteen seconds at reduced energy followed by a 1 minute waiting period, with the procedure repeated two additional times. Following this soft-start procedure, impact or vibratory driving at operational power may commence provided marine mammals remain absent from the pile driving monitoring zone.
16. The PSOs will continuously monitor the monitoring zones during in-water activities for the presence of marine mammals and will order the in-water activities to immediately cease if one or more marine mammals appears likely to enter the monitoring zones.
17. In-water activities will cease immediately when the PSO indicates that marine mammals are likely to enter, or are observed within, the monitoring/exclusion zones. When a marine mammal or other protected species is observed approaching an applicable monitoring zone, the PSO on duty will immediately call or radio the operators and initiate a shutdown of in-water activities. If direct communication with the operators is not practical, the foreman/superintendent will relay the shutdown order to the equipment operators.
18. To the extent practicable, pile driving will begin as early in the day as conditions allow for effective monitoring of the entire monitoring zone (visibility greater than 984 ft (300 m) and Beaufort Sea state of 4 or less) in an attempt to complete most or all of the pile driving in a single day prior to nightfall.
19. Monitoring will take place during daylight conditions with adequate visibility (6 km or greater) and Beaufort Sea state (4 or less), starting 30 minutes before soft-start procedure begins.
20. If visibility degrades to less than 984 ft (300 m) during pile driving, pile driving of the section of sheet pile that was being driven when visibility fell below 984 ft (300 m) may continue to the target depth of that sheet pile but will not drive additional sections of piling. If pile driving is suspended (to weld on a new section, for example) when the monitoring zone is not visible, pile driving will not resume until visibility exceeds 984 ft (300 m) and the PSO has indicated that the zone has remained devoid of marine mammals for 30 minutes prior to additional pile driving.
21. If visibility degrades to less than 984 ft (300 m) during non-pile driving in-water activities, activity will cease until the monitoring zone visibility exceeds 984 ft (300 m) and the PSO has indicated that the zone has remained devoid of marine mammals for 30 minutes prior to

additional activity.

22. Following a lapse of in-water activities of more than 30 minutes (due to time spent welding a new section of pipe, low visibility conditions, shutdown due to presence of marine mammals, mechanical delays or other causes), the PSO will authorize resumption of activities (using soft-start procedures for pile driving) only after the PSO provides assurance that listed marine mammals have not been present in the monitoring zones for at least 30 minutes immediately prior to resumption of operations.
23. Following shutdown of in-water activities for less than 30 minutes due to the presence of marine mammals in the monitoring zone, pile driving may commence when the PSO provides assurance that listed marine mammals were observed exiting the monitoring zones or have not been seen in the monitoring zones for 30 minutes (for cetaceans) or 15 minutes (for pinnipeds and sea otters).
24. PSOs will have immediate communication with the equipment operator (or other person in charge [PIC] if direct communication is not practical), either by radio or phone to ensure timely shutdowns to avoid takes and prevent prolonged sound exposure to marine mammals.
25. Shutdown procedures will be initiated at the PSO's direction when warranted due to the presence of marine mammals; the PSO will authorize resumption of in-water activities only when the PSO visually observes the marine mammal(s) as having left the monitoring zone, or when the PSO has not seen the animal(s) within the monitoring zone for 15 minutes (for pinnipeds and sea otters) or 30 minutes (for cetaceans).
26. PSO records associated with all marine mammals observed during in-water activities must be transmitted to NMFS and USFWS (see item 27) by the end of the calendar year during which observations were made. These records will contain the information specified in item 13.
27. A final report will be submitted to NMFS and USFWS within 90 calendar days of the completion of the project summarizing the data recorded as per measure 13 and submitted to Greg Balogh, NMFS PRD ANC supervisor, at greg.balogh@noaa.gov and Kimberly Klein, USFWS Incidental Take Coordinator, at kimberly_klein@fws.gov.
28. Though take is not authorized, if a listed marine mammal is determined by the PSO to have been disturbed, harassed, harmed, injured, or killed (e.g., a listed marine mammal(s) is injured or killed or is observed entering the monitoring zones before operations can be shut down), it must be reported to NMFS within one business day (contact listed below, item 29). These PSO records must include:

    a. Information that must be listed in the PSO report
    b. Number of listed animals affected.
    c. The date and time of each event.
    d. The cause of the event (e.g., Stellar sea lion approached within 10 m of an impact hammer while in operation).
    e. The time the animal(s) entered the monitoring zone, and, if known, the time it exited the zone.
    f. Mitigation measures implemented prior to and after the animal entered the monitoring zone.

29. If PSOs observe an injured, sick, or dead cetacean or pinniped (i.e., stranded marine mammal), they shall notify the NMFS Alaska Region Marine Mammal Stranding Network at 1-877-925-7333. The PSOs will submit photos and data that will aid NMFS in determining how to respond

to the stranded animal. Data submitted to NMFS in response to stranded marine mammals will include date/time, location of stranded marine mammal, species and number of stranded marine mammals, description of the stranded marine mammal's condition, event type (e.g., entanglement, dead, floating), and behavior of live-stranded marine mammals. In the case of a distressed or dead sea otter, the PSOs shall contact the Marine Mammals Management office of the USFWS at 1-800-362-5148.

30. In the event of an oil spill in the marine environment, the permittees shall immediately report the incident to: the USCG 17th District Command Center at 907-463-2000, and NMFS AKR, Protected Resources Division Oil Spill Response Coordinator at 907-586-7630 and/or email (sadie.wright@noaa.gov).

6.3. Mitigation Measures – Vessel Strike

Vessel speeds will be limited to 10 kt (18.5 km/hr) for all Project construction vessels to mitigate potential vessel strike with marine mammals.

7. DIRECT EFFECTS

7.1. Humpback Whale

7.1.1. Disturbance

Lower Cook Inlet supports a small number of humpback whales, some of which might be present in the Amakdedori Port construction Action Area while construction activities are occurring. The port construction Action Area was determined based on a maximum distance (11.3 mi; 18.2 km) that continuous noise levels from vibratory pile driving exceeds the 120-dB Level B threshold (see Section 2.2). Therefore, it is assumed that any humpback whale occurring within the Action Area during vibratory pile driving could potentially be exposed to harassment-level sound pressures, although establishing shutdown safety zones to limit the number of exposures will be considered as a mitigation measure.

As mentioned in Section 2.2, harassment-level disturbance (exceeding 160 dB SPL) can extend from a few hundred feet to a couple of miles (Blackwell 2005, URS 2007, SFS 2009). Which value (radius) is the most appropriate for this project will be determined (finalized) in the IHA process. Regardless of the value selected, Pebble will establish monitoring and shutdown safety radii (under the 4MP) around the pile driving source thereby limiting the potential of humpback whale takes. These zones will be monitored by trained PSOs with the assignment of "clearing" the safety zone of marine mammals, including humpback whales, before activities commence. The project will also use attenuation devices to mitigate impact pile driving source levels (see Section 6).

Because pile driving is a temporary activity, its effects are likely insignificant at a population level given the low densities of humpback whales (see Section 4.1.3) where these activities would occur, although individual whales could be disturbed given the maximum radius to threshold (11.3 mi; 18.2 km). The determination is ***May Affect, Likely to Adversely Affect*** for disturbance as there is possibility of humpback whales being exposed to harassing levels of pile driving noise.

7.1.2. Vessel Strike

While it is important to note that humpback whales comprise most vessel strike records in Alaska (Neilson et al. 2012), the risk of strike in the Action Area is low to the point of discountable because of the low (<10 kt [18.5 km/hr]) travel speed of the vessels involved. Therefore, the determination is ***No Effect***.

7.1.3. Entanglement

The two spread anchor moorings systems at the lightering locations and two navigational lighting buoys, will include chains for anchoring to the seafloor, which could pose an entanglement risk for humpback whales. The spread anchor moorings are of greater concern because of their placement in deeper water that is more likely to be frequented by humpback whales. However, the 2-in (5.1-cm) anchor chain size will keep the chain relatively and prevent kinking avoiding or minimizing entanglement risk. None of the proposed anchoring systems involves rope, which is the primary cause of marine mammal entanglement. The exact risk of entanglement is unknown but is considered discountable given no rope will be used. Therefore, the determination is ***No Effect***.

7.1.4. Incidental Spill

Humpback whales are not found in shallow-water harbors (Amakdedori Port) where incidental spills are most likely to occur. PLP and their construction contractors must comply with all laws and regulations related to spill prevention and preparedness for petroleum lubricants and fuel, including 40 CFR part 110, and those related to vessel-to-vessel transfer, including 33 CFR part 144. Construction operations would implement spill prevention control measures, and in the event of a spill would facilitate a rapid response and cleanup operation. The required operation safeguards would minimize the occurrence of spills, size, and extent. Potential incidental spills in Kamishak Bay and Cook Inlet would quickly dissipate in the water due to the high flushing rate of Cook Inlet waters. The determination is ***No Effect***.

7.1.5. Effects on Critical Habitat

There is no designated critical habitat for humpback whales.

7.2. Fin Whale

7.2.1. Disturbance

Lower Cook Inlet supports very few fin whales, but as mentioned with humpback whales (Section 7.1.1), there is the potential for pile driving disturbance to this species. The likelihood of a take due to exposure to threshold-level pile driving noise is remote given the location of past fin whale sightings in lower Cook Inlet, plus the required presence of PSOs (under Marine Mammal Protection Act [MMPA] regulations) and implementation of a shutdown safety zone that would greatly limit take of any fin whales that might be present in the Action Area. The project will also use bubble curtains to mitigate the sound source levels from impact pile driving. However, acoustical harassment of individual whales is not totally discountable given the maximum distance to Level B thresholds (11.3 mi; 18.2 km), thus the determination is ***May Affect, Likely to Adversely Affect*** for disturbance.

7.2.2. Vessel Strike

Worldwide, fin whales are the most vulnerable marine mammal to vessel strike largely because of their distributional overlap with shipping lanes and the whales' limited maneuverability (Laist et al. 2001, Jensen and Silber 2004). However, because of the low (<10 kt [18.5 km/hr) vessel speed, the risk of a vessel strike is essentially discountable for barges. Therefore, the determination is ***No Effect*** as the vessels proposed for construction lack the speed to pose a strike threat to fin whales.

7.2.3. Entanglement

The risk of fin whale entanglement in construction anchor chains or cables is the same discountable risk as mentioned for humpback whales in Section 7.1.3. Therefore, the determination is ***No Effect.***

7.2.4. Incidental Spill

Fin whales are not found in shallow-water harbors (Amakdedori Port) where incidental spills associated with construction are most likely. The fin whale incidental spill risk is the same discountable risk as mentioned for humpback whales in Section 7.1.4. The determination is ***No Effect***.

7.2.5. Effects on Critical Habitat

There is no designated critical habitat for fin whales.

7.3. Beluga Whale – Cook Inlet Stock

7.3.1. Disturbance

All proposed construction activity, including port construction, construction supply barging, and pipeline laying would occur during the summer months when beluga whales are found approximately 170 mi (275 km) farther north in upper Cook Inlet (Susitna Flats). Additionally, beluga whales have discontinued winter use of the Action Area in recent years (Rugh et al. 2010, Shelden et al. 2017). As a consequence, the determination is ***No Effect*** for disturbance because of a lack of both temporal and spatial overlap of the Action Area and current beluga whale distribution.

7.3.2. Vessel Strike

Vessel strike risk from the slow moving (less than 10 kt [18.5 km/hr]) tug/barge is low. As mentioned earlier, there are no records of lethal vessel strikes involving Cook Inlet beluga whales, (although Kaplan et al. [2009] did record what appeared to be marks from a small propeller on at least two whales during photo-identification studies conducted from 2005 to 2008). Beluga whales, a maneuverable toothed whale, may be somewhat susceptible to strike by a fast-moving small fishing boat as the known strike marks suggest, but they are very unlikely to be struck by a tug/barge moving at less than 10 kt (18.5 km/hr). Also, as mentioned in Section 7.3.1, there is no temporal overlap between construction and summer beluga whale distribution. Therefore, the determination is ***No Effect*** for vessel strike.

7.3.3. Entanglement

Although beluga whales have been entangled in fishing gear, especially nets, entanglement in mooring and other anchoring chains has not been recognized as concerning threat. The determination is ***No Effect*** for entanglement.

7.3.4. Incidental Spill

Construction operations would implement spill prevention control measures, and in the event of a spill would facilitate a rapid response and cleanup operation. The required operation safeguards would minimize the occurrence of spills, the size, and extent of any spill to the immediate area. Potential incidental spills in Kamishak Bay and Cook Inlet would quickly dissipate in the water due to the high flushing rate of Cook Inlet waters. Further, beluga whales would not present during the summer activities, and have not been found in Kamishak Bay during the winter in recent years (Rugh et al. 2010, Shelden et al. 2017). Thus, the determination is ***No Effect*** for incidental spill given a lack of temporal or spatial overlap with current beluga whale distribution and such an event.

7.3.5. Effects on Critical Habitat

Port construction would occur in Kamishak Bay beluga whale critical habitat with the potential of impacting intertidal and subtidal waters (PCE # 1) with the placement of the causeway and dock facilities. However, the amount of habitat directly affected is only 10.7 acres (ac) (4.3 hectares [ha]), an extremely small amount given remaining critical habitat available in Cook Inlet and the apparent decline in beluga whale use of lower Cook Inlet in recent years (Rugh et al. 2010, Shelden et al. 2017).

Impact pile driving could result in the injury of juvenile fish, especially salmon smolts, that are important prey for beluga whales (PCE # 2). However, the effect on prey availability for beluga whales is small to the point of discountable.

Incidental spills could result in the release of small amounts of toxic petroleum products into marine waters (PCE # 3). However, given the small amount of potential spill, and the time (between summer construction period and winter beluga whale use of lower Cook Inlet critical habitat) for the toxin to dilute and dissipate, potential effects to beluga whales are low to the point of discountable.

The construction activity will not prevent unrestricted passage of beluga whales between the critical habitat areas (PCE # 4).

While the construction activities will result in an increase in in-water noise levels (PCE # 5), construction will not occur in the winter months when beluga whales are potentially present in the Action Area, therefore there will be no temporal overlap between construction and whale use leading to potential abandonment of habitat by these whales.

Overall, the proposed construction has the potential to impact three of the five PCEs identified for Cook Inlet beluga whales, but all these potential impacts are small enough to be discountable. Therefore, the project determination is ***No Effect*** for Cook Inlet beluga whale critical habitat.

7.4. Steller Sea Lion – Western DPSs

7.4.1. Disturbance

Because the effective hearing of Steller sea lions is largely above the major noise frequencies of cavitating propellers and they appear adapted to hear important sounds in noisy backgrounds, Steller sea lions are likely not susceptible to continuous noise disturbance in open water. Also, there are no PTS concerns because Steller sea lions remain underwater for only short periods of time and, thus, there are no long-duration exposures to underwater noise. Further, noise impacts will be limited using PSOs to monitor shutdown safety zones to ensure sea lions are not exposed to injurious noise levels (Level A) from pile driving, and bubble curtains will likely be used to mitigate pile driving source levels. However, the determination for disturbance of Steller sea lions is ***May Affect, Likely to Adversely Affect*** because while several mitigation measures will be in place to limit noise impacts, sea lions could still be exposed to harassing levels of underwater noise during construction activities (e.g., pile driving) construed as take.

7.4.2. Vessel Strike

Sea lions are highly maneuverable and, thus, not very susceptible to vessel strike, especially with a vessel traveling at less than 10 kt (18.5 km/hr). From 1978 to 2014, there have been only four confirmed sea lion mortalities in Alaska resulting from ship collisions (NMFS, unpublished data). Collision with a tug/barge is highly unlikely to the point of discountable. The determination is ***No Effect*** for vessel strike.

7.4.3. Entanglement

As with beluga whales, sea lions may become entangled in fishing gear, such as nets, but there is a lack of evidence that they are susceptible to anchor chain or cable entanglement. The determination is ***No Effect***.

7.4.4. Incidental Spill

Incidental spills associate with port construction or pipeline laying will be limited in size and extent due to required safety measures that will be put in place. From the perspective of sea lion habitat in Cook Inlet, the risk from a low-volume spill is discountable. Thus, the determination for incidental spill is ***No Effect***.

7.4.5. Effects on Critical Habitat

The nearest critical habitat occurs 9.5 mi (15.3 km) away from the Action Area, falling well outside any reasonable impact zone due to construction noise or potential incidental spills. The determination is ***No Effect*** for Steller sea lion critical habitat given the distance the nearest critical habitat is from the proposed construction activities.

8. INDIRECT EFFECTS

Indirect effects are those that are caused by or will result from the proposed action and are later in time but are still reasonably certain to occur. Given that the port and pipeline construction are a prelude to the Pebble mine construction and operation, any activities associated with mine operation that potentially affect ESA-listed species could be construed as an indirect effect.

These mine (marine) operation activities that could affect listed species include:

- Transport of four million gallons (gal) of diesel fuel at a time (transit spill risk)
- Transfer of diesel fuel to port storage tanks (transfer spill risk)
- Transport of ore (potential collision risk from bulk carriers)

No other indirect effects (or interrelated effects) to listed marine mammals under NMFS jurisdiction have been identified.

9. CUMULATIVE EFFECTS ANALYSIS

Several projects are planned for Cook Inlet that would also contribute noise risk to local marine mammals including the Alaska Liquefied Natural Gas pipeline project and several oil and gas seismic and drilling programs planned in both upper and lower Cook Inlet. All these projects will have associated mitigation and monitoring plans designed to limit impacts to Cook Inlet marine mammals.

10.DETERMINATION OF EFFECTS SUMMARY

A determination of effects for each species for the five evaluated risk categories is provided in Table 4.

Table 4: Determination of effects for each ESA-listed species potentially occurring within PLP's proposed Action Area.

Species	Noise Disturbance	Vessel Strike	Entanglement	Incidental Spill	Critical Habitat	Overall
Humpback Whale – *Mexico DPS and Western North Pacific DPS*	LAA	NE	NE	NE	N/A	LAA
Fin Whale	LAA	NE	NE	NE	N/A	LAA
Beluga Whale – *Cook Inlet Stock*	NE	NE	NE	NE	NE	NE
Steller Sea Lion – *Western DPS*	LAA	NE	NE	NE	NE	LAA

NE = No Effect
LAA = May Affect, Likely to Adversely Affect

The ***May Affect, Likely to Adversely Affect*** determinations for humpback whales, fin whales, and Steller sea lions are based entirely on the portion of the pile driving ensonification area that could not be effectively monitored as a shutdown safety zone leading to acoustical harassment of any of these marine mammals that are present beyond the safety zone.

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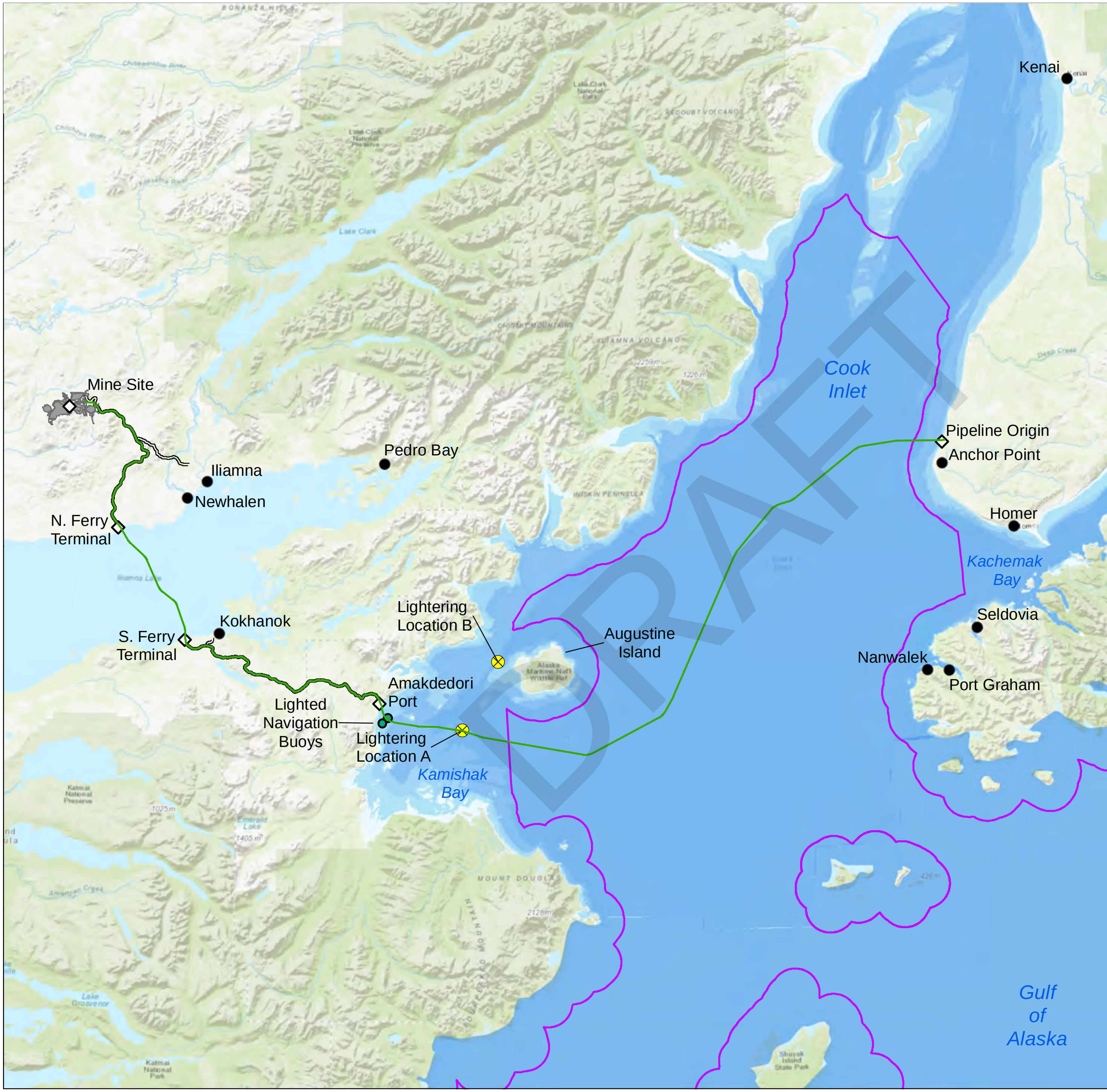
FIGURES



Project Feature
Lightering Location
Lighted Navigation Buoys
Proposed Access Road
Proposed Natural Gas Pipeline
Outer Continental Shelf Boundary (3nm)
Proposed Mine Site

Miles
0 10 20 30
Scale 1:1,300,000

NAD 1983 StatePlane Alaska 5 FIPS 5005 Feet Seward Meridian	Figure: **1**

PROJECT COMPONENTS

NMFS Biological Assessment

File: PLP047	Date: 12/13/2018
Revision: 07	Author: RC/OR

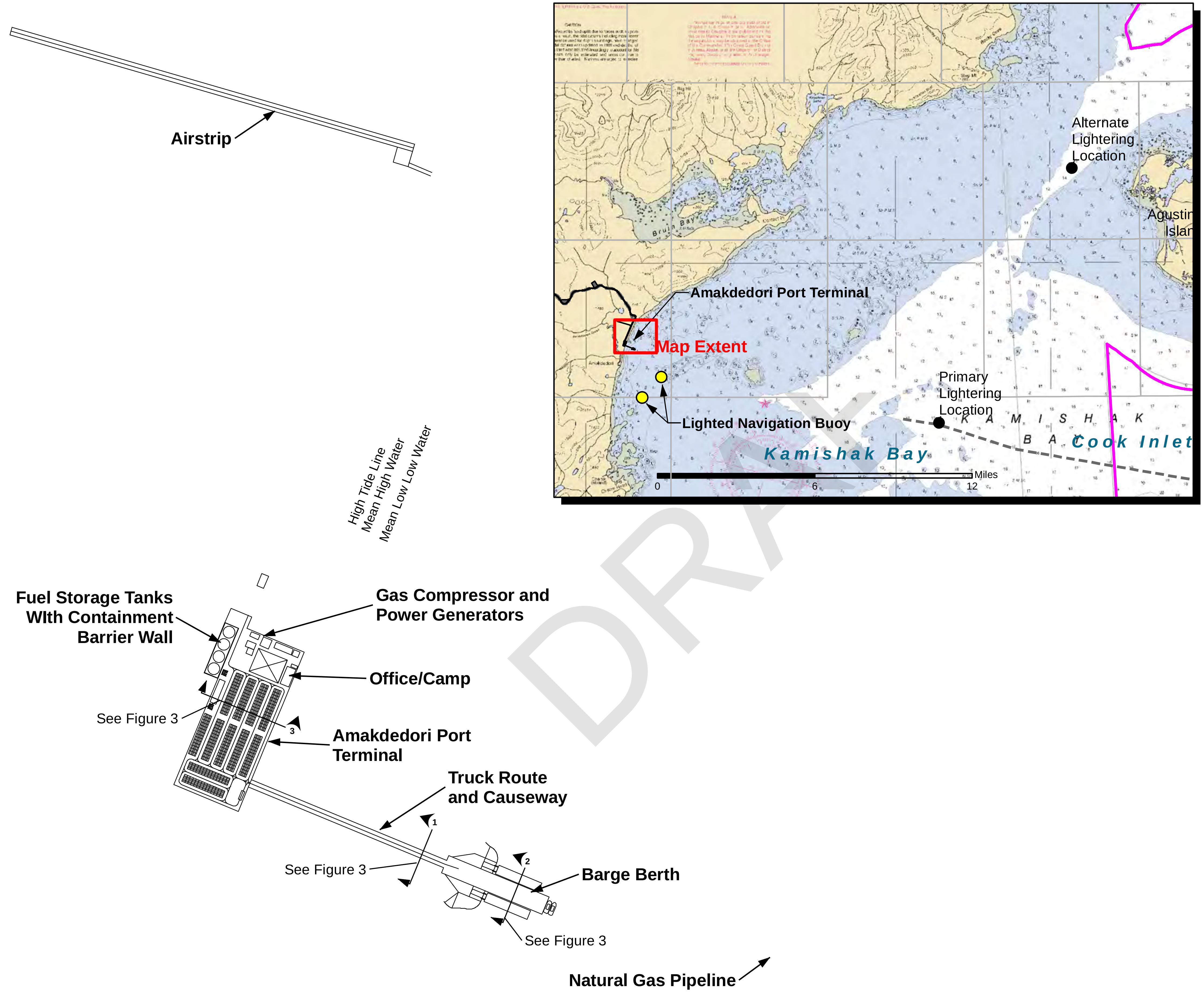
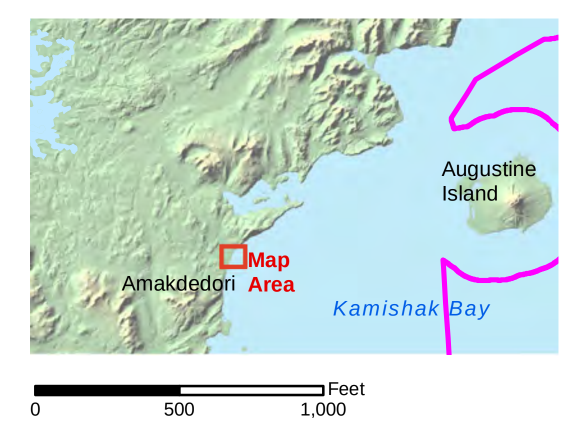


FIGURE 2

AMAKDEDORI PORT AND LIGHTERING LOCATIONS

- Amakdedori Port Site Footprint
- Primary / Alternate Lightering Locations
- Lighted Navigation Buoy
- Transportation Corridor
- Natural Gas Pipeline
- High Tide Line
- Mean High Water
- Mean Low Low Water (MLLW)
- Bathymetric Contours (Feet from MLLW)*
- Outer Continental Shelf Boundary

*Offshore contours developed from Terrasond bathymetric survey dated August 20 to 27, 2017. Elevations surveyed to geodetic datum (GEOID 99) and are shifted to mean lower low water (MLLW) level based on limited field measured tidal data. Preliminary shift between geodetic and MLLW is +8.37' (0' geodetic = 8.37' MLLW)



0 500 1,000 Feet

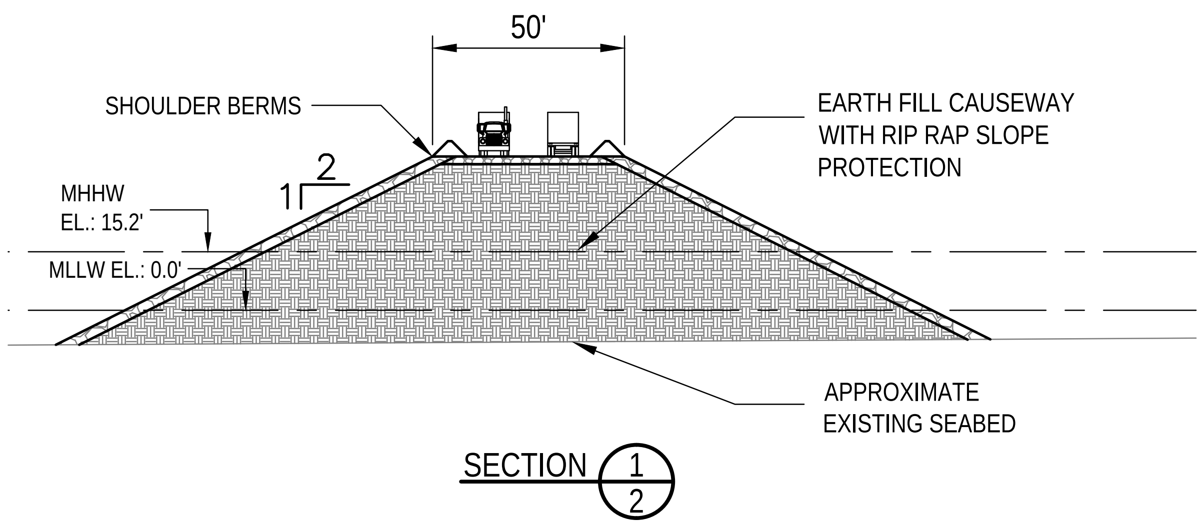
N

NMFS Biological Assessment

Scale 1:8,000

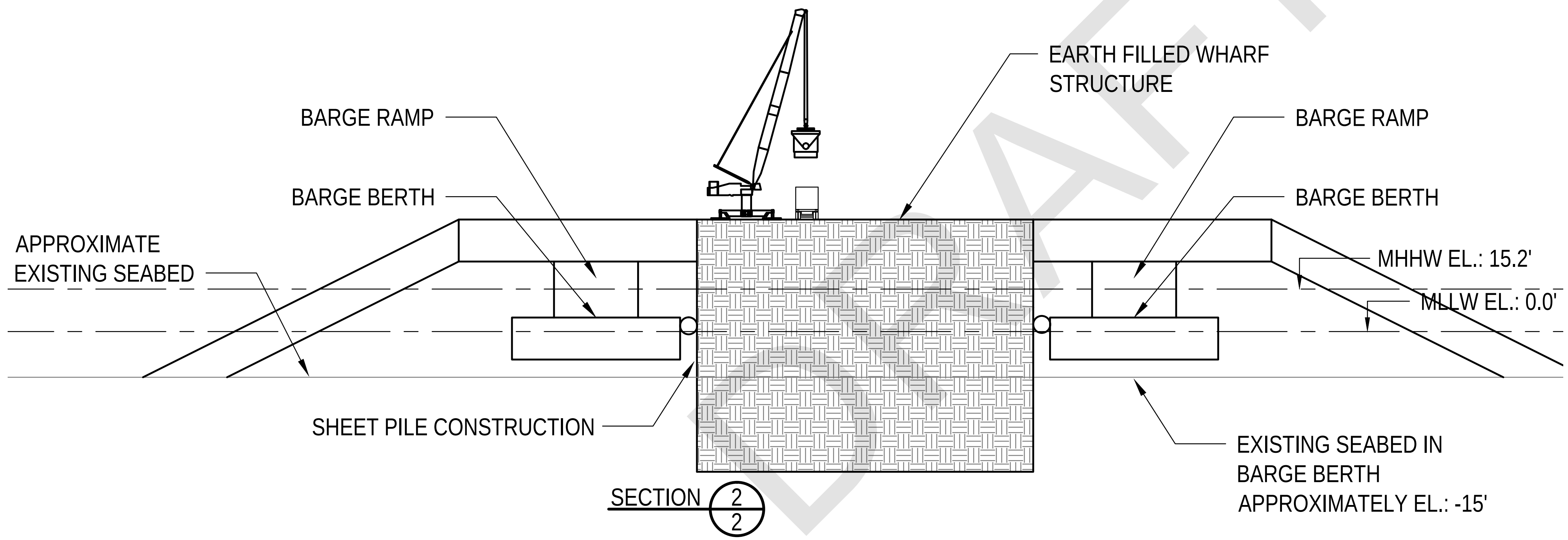
Alaska State Plane Zone 5 (units feet)
1983 North American Datum

File: PLP_AmakdedoriPort_Lightering_NMFS.mxd	Date: 12/14/2018
Version: x	Author: HDR



NOTES:

1. DIMENSIONS IN FEET
3. HORIZONTAL DATUM TO UTM NAD83, ALASKA STATE PLANE ZONE 5, US SURVEY FEET
4. ELEVATIONS ARE IN FEET TO MEAN LOWER LOW WATER (MLLW)
5. MEAN LOWER LOW WATER (MLLW), HIGH TIDE LINE (HTL), AND MEAN HIGH WATER (MHW) ARE BASED ON USACE ALASKA DISTRICT TIDE DATA AT SELDOVIA



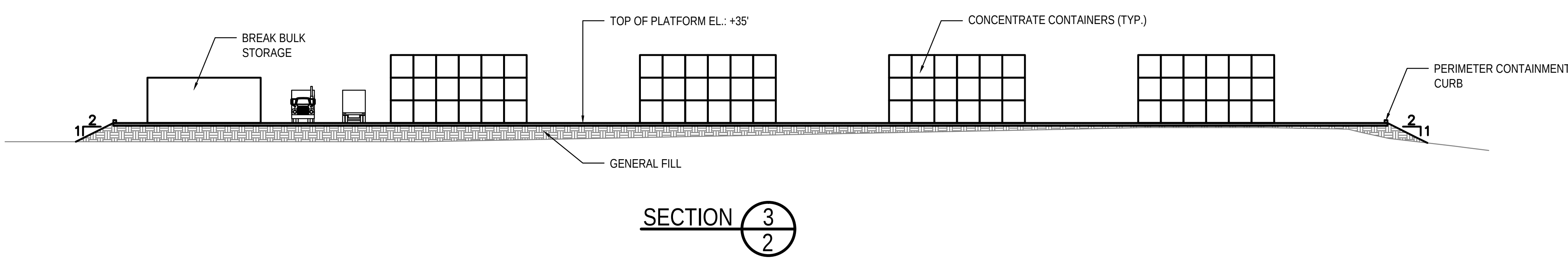
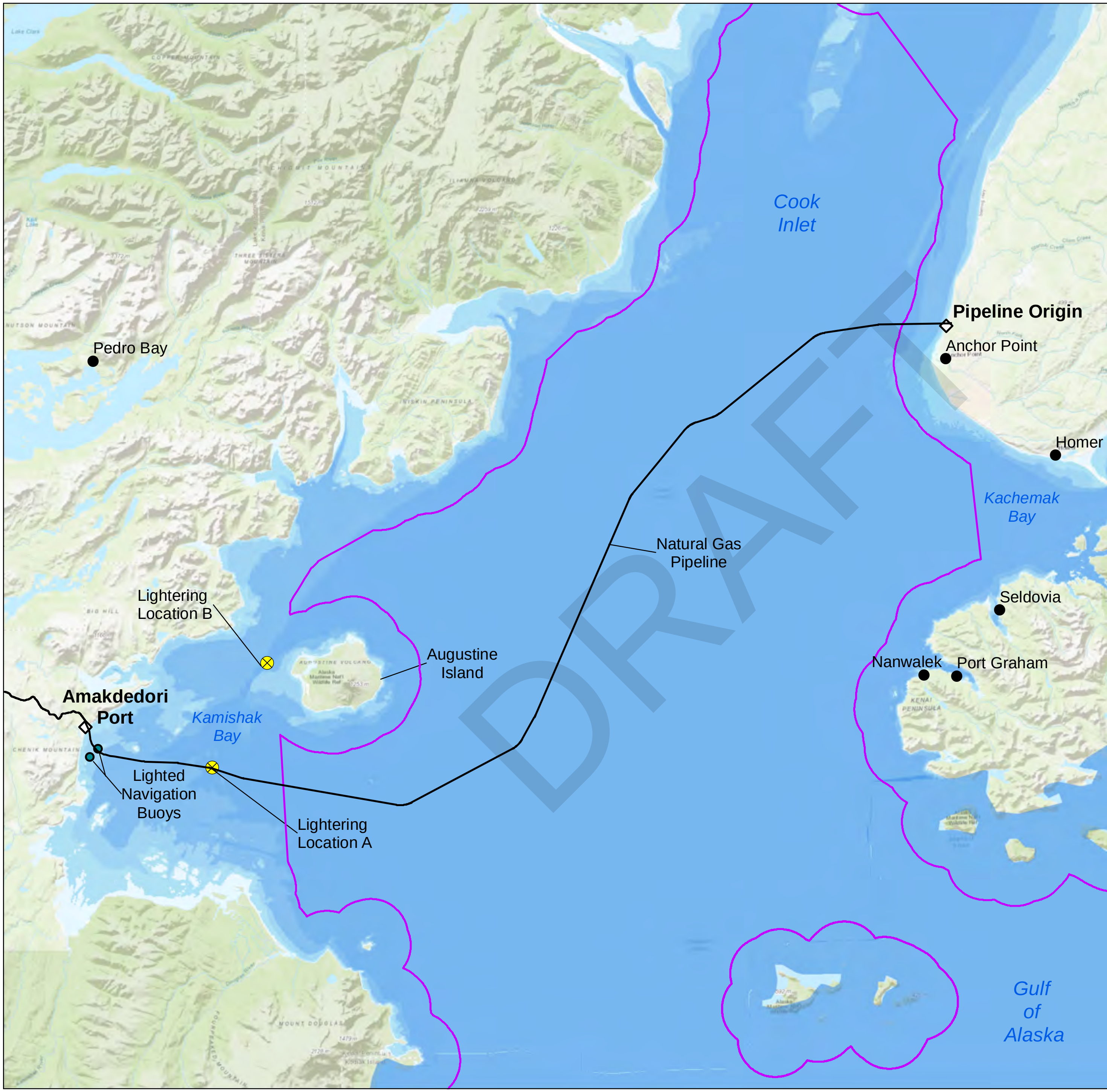


FIGURE 3

AMAKDEDORI PORT CROSS SECTIONS

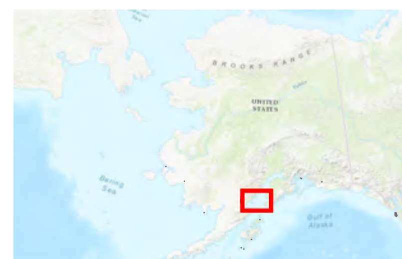
NMFS Biological Assessment

File: PLP_AmakdedoriPort_CrossSections.mxd	Date: 10/9/2018
Version: x	Author: HDR



THE pebble PARTNERSHIP

- Project Feature
- Lighted Navigation Buoys
- Lightering Location
- Proposed Natural Gas Pipeline
- Outer Continental Shelf Boundary (3nm)



Miles 0 5 10 15 20

Scale 1:850,000

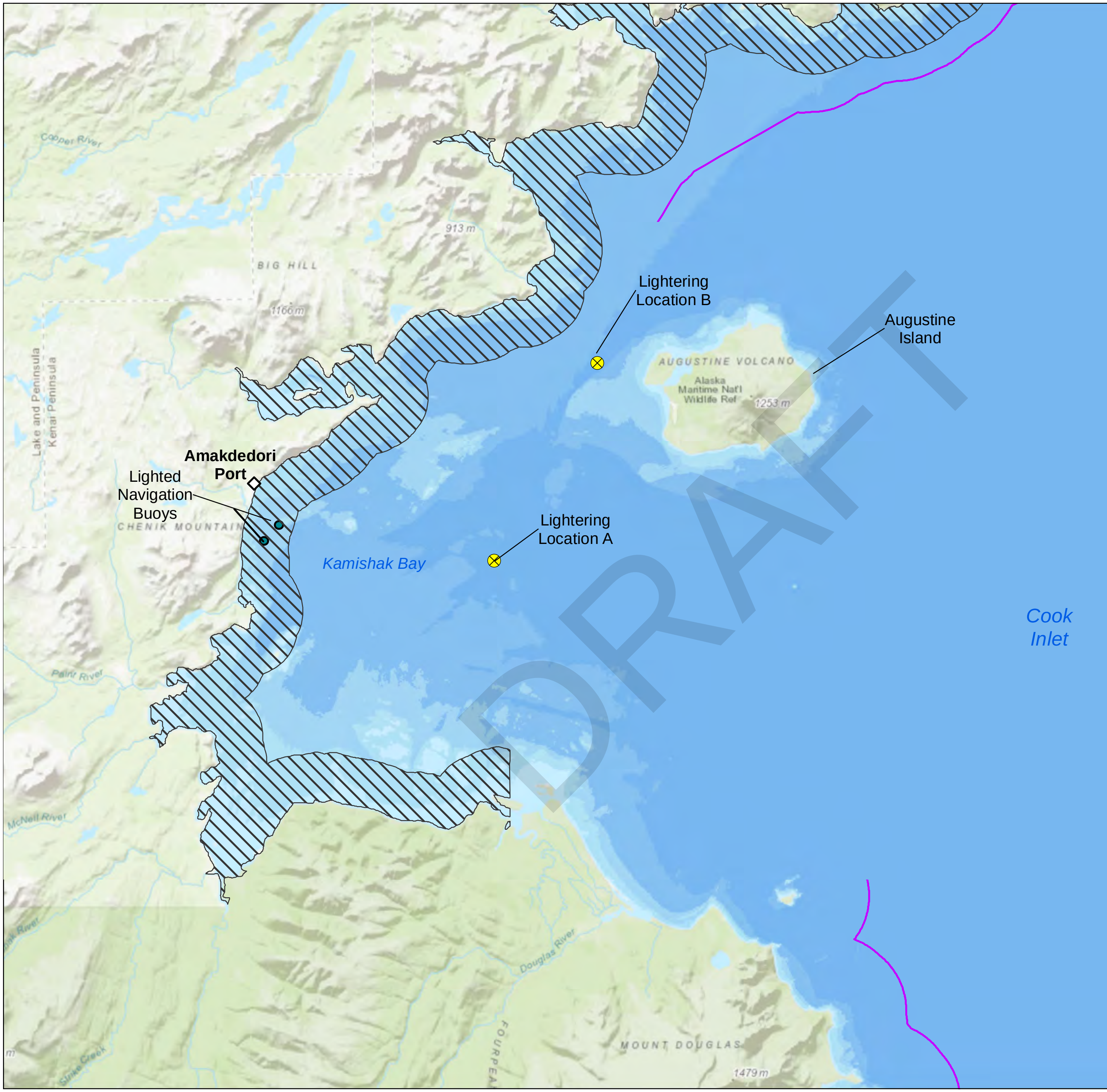
N

NAD 1983 StatePlane Alaska 5 FIPS 5005 Feet Seward Meridian	Figure: **4**

PROPOSED PIPELINE LOCATION

NMFS Biological Assessment

File: PLP049	Date: 12/13/2018
Revision: 06	Author: RC/OR



THE pebble PARTNERSHIP

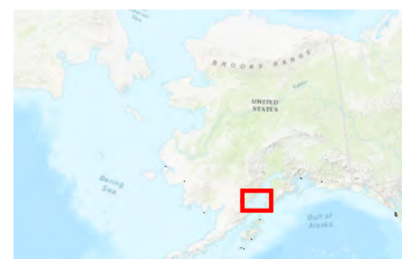
Project Feature

Lightering Location

Navigation Lights

Outer Continental Shelf Boundary (3nm)

Cook Inlet Beluga Critical Habitat



Miles

0 2 4 6 8 10

Scale 1:450,000

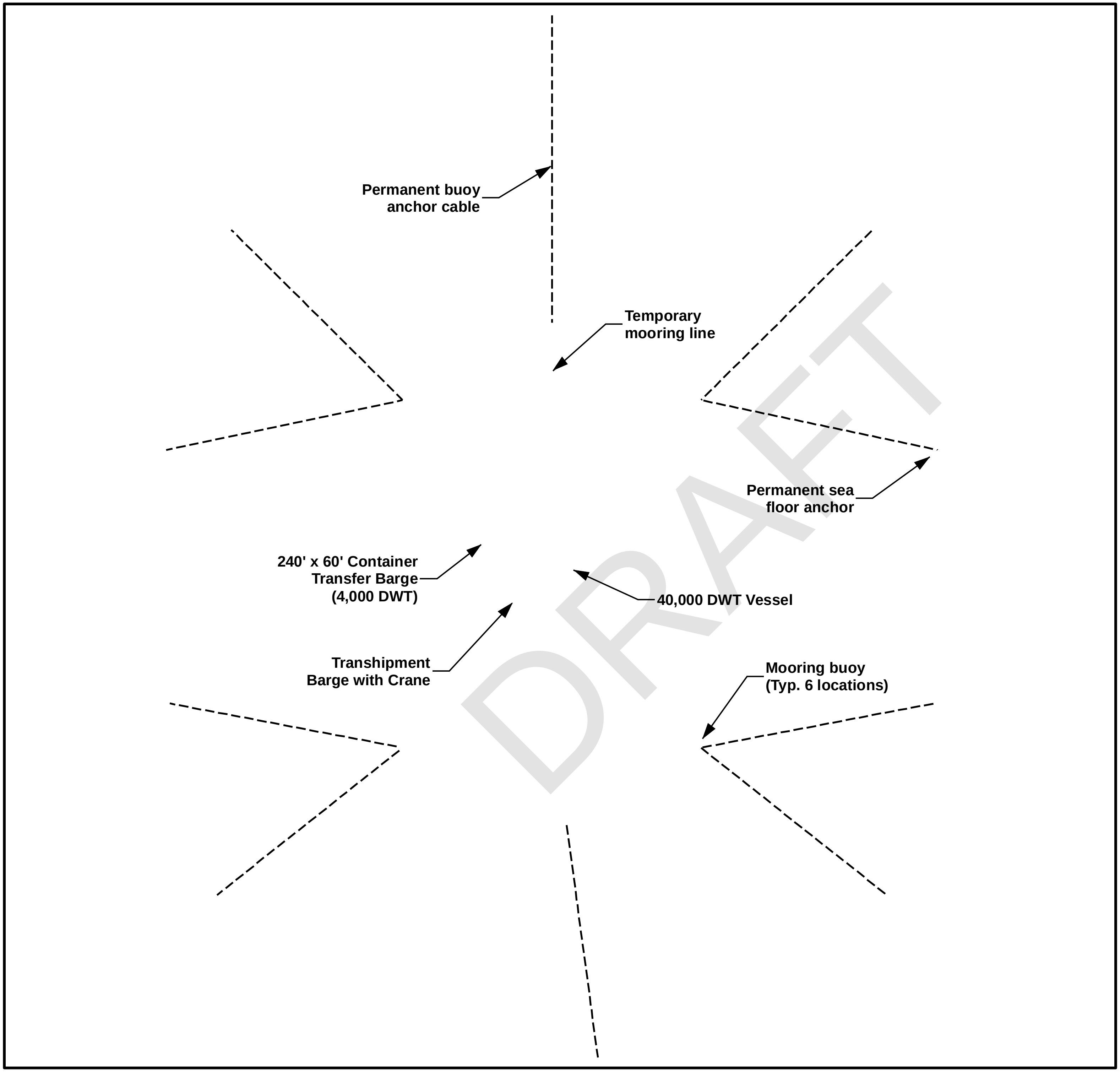
NAD 1983 StatePlane
Alaska 5 FIPS 5005 Feet
Seward Meridian

Figure:
5

PROPOSED LIGHTERING LOCATIONS

NMFS Biological Assessment

File: PLP087	Date: 12/14/2018
Revision: 04	Author: RC/OR



THE pebble PARTNERSHIP

FIGURE 6

SPREAD ANCHOR MOORING SYSTEM

- 40,000 DWT Vessel
- Container Transfer Barge (4,000 DWT)
- Transhipment barge with crane
- Temporary mooring lines
- Floating mooring buoys
- Permanent buoy anchor cables
- Permanent sea floor anchors

NMFS Biological Assessment

Feet: 0, 300, 600

Meters: 0, 90, 180

N

Scale 1:3,600

Alaska State Plane Zone 5 (units feet)
1983 North American Datum

File:	Date: 12/14/2018
Version: x	Author: HDR

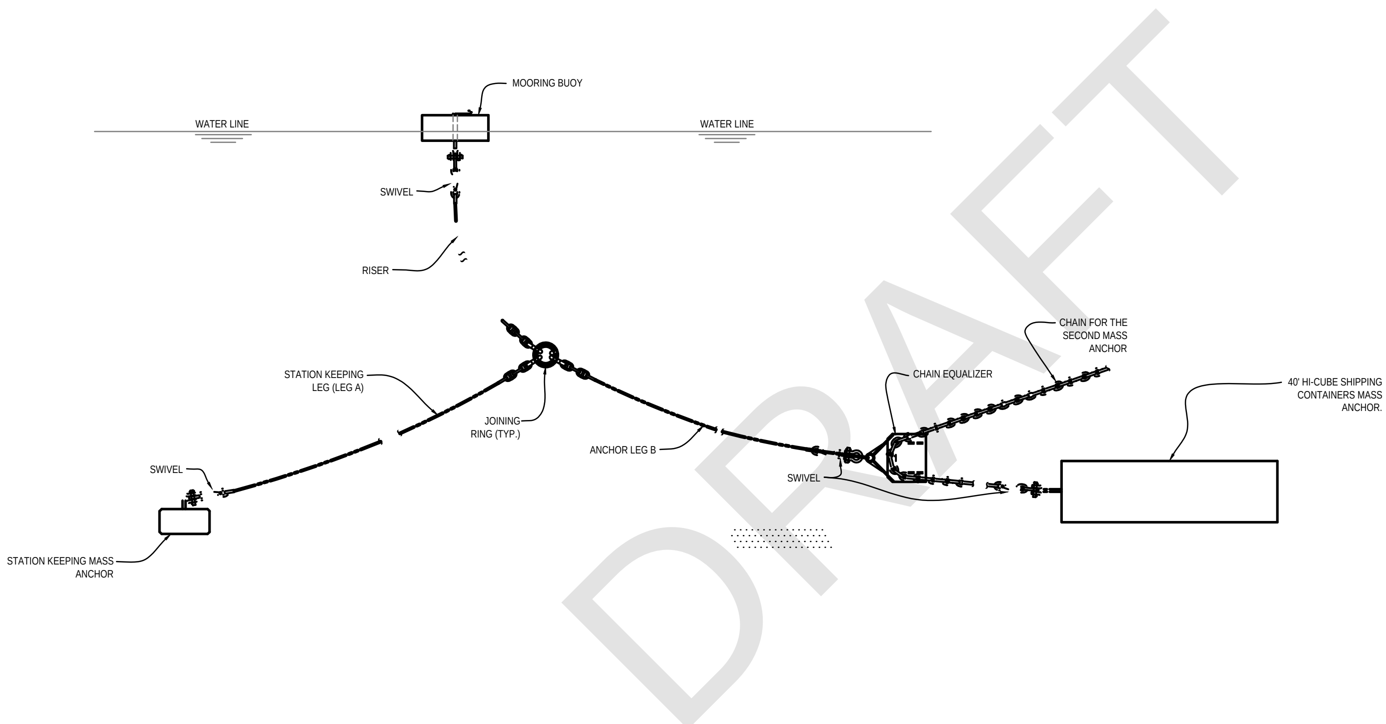
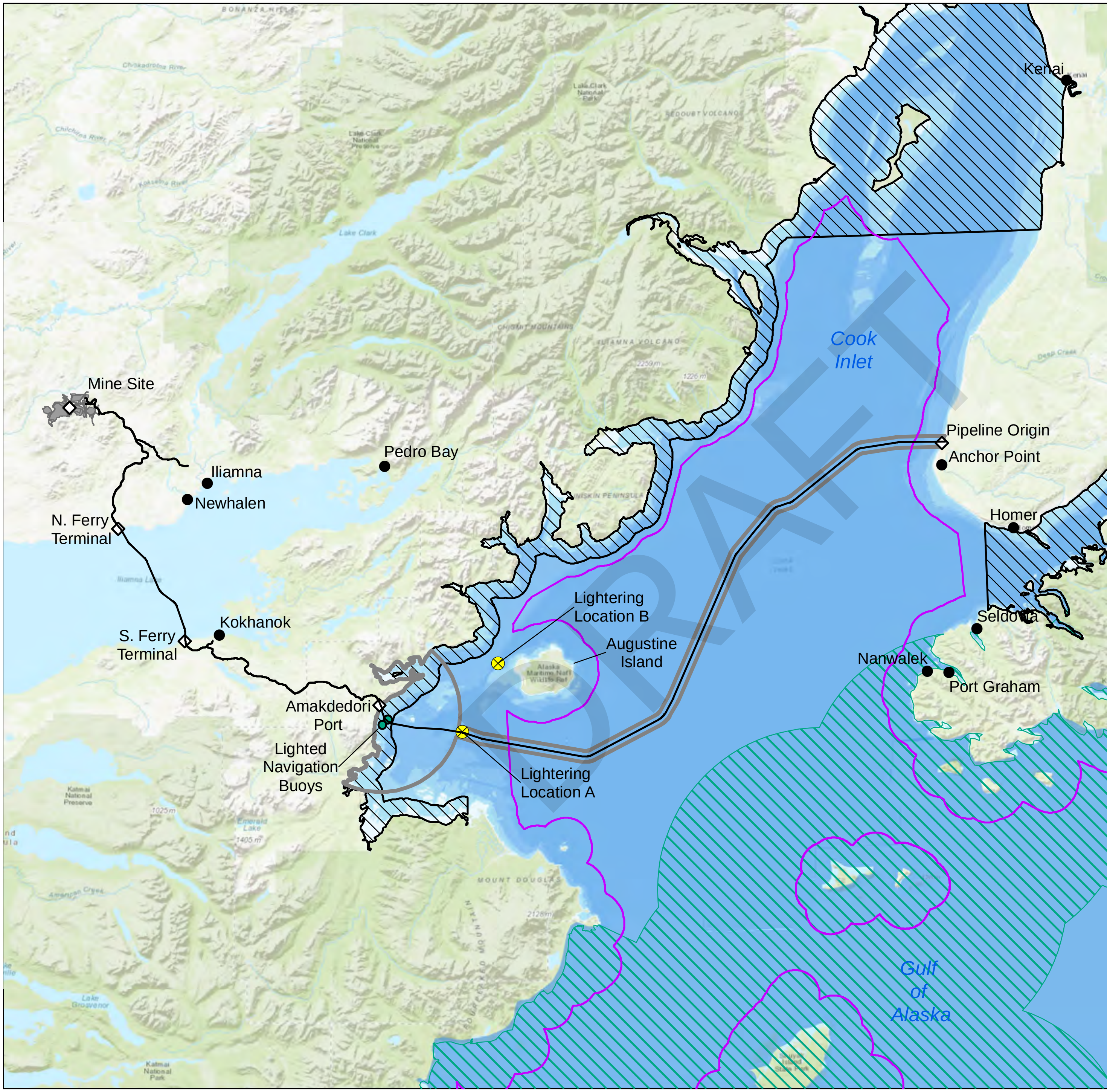


FIGURE 7

TYPICAL ANCHOR ARRANGEMENT

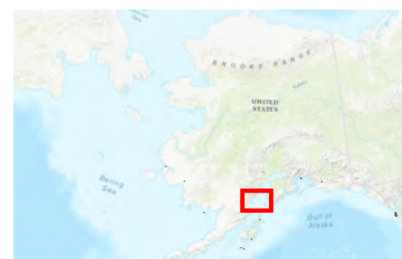
NMFS Biological Assessment

File:	Date: 10/1/2018
Version: x	Author: HDR



THE pebble PARTNERSHIP

- Project Feature
- Lightering Location
- Lighted Navigation Buoys
- Project Component
- Outer Continental Shelf Boundary (3nm)
- Action Area
- Cook Inlet Beluga Critical Habitat Area
- Steller Sea Lion Critical Habitat Area



Miles
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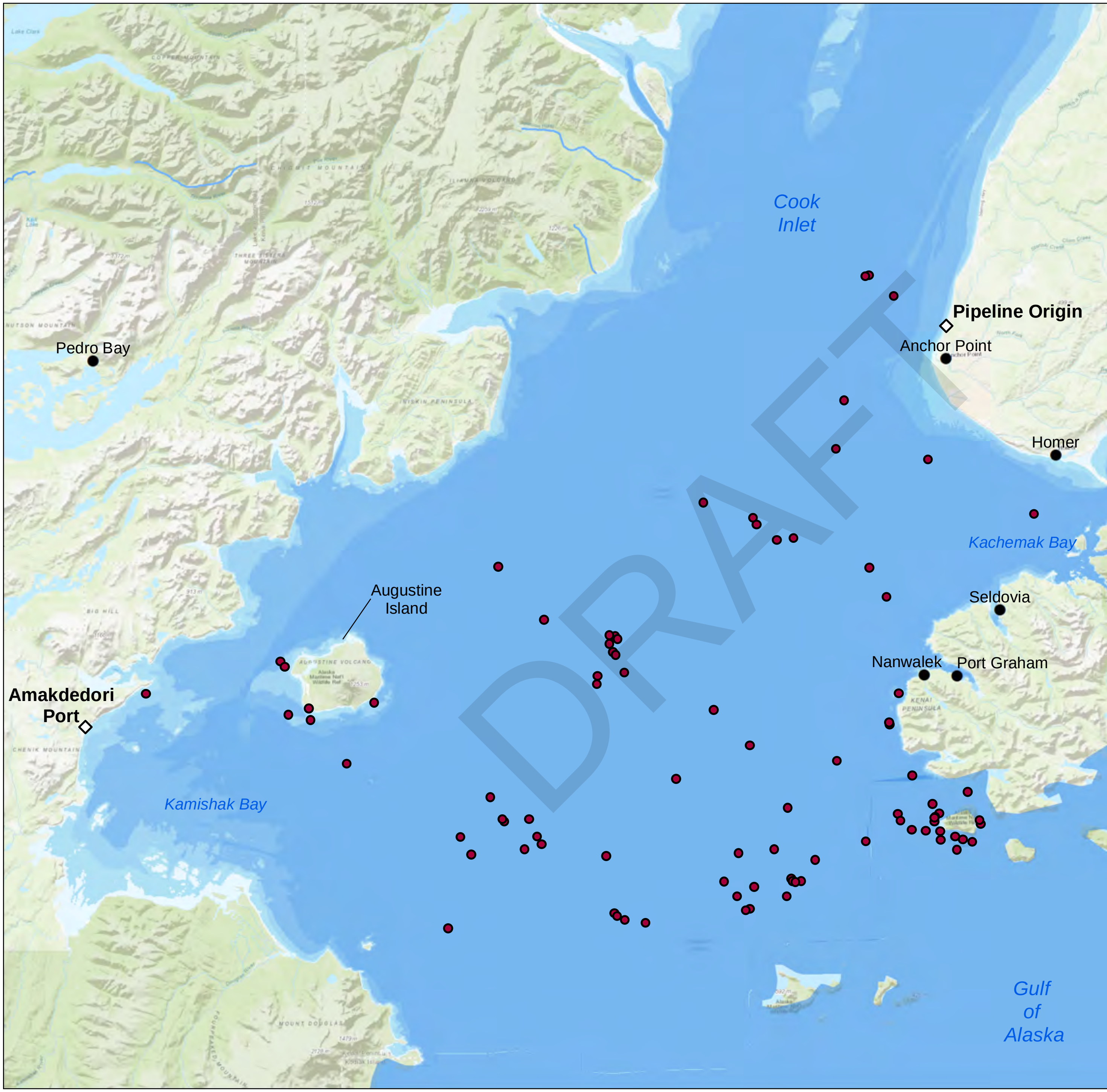
Scale 1:1,300,000

NAD 1983 StatePlane Alaska 5 FIPS 5005 Feet Seward Meridian	Figure: **8**

PROJECT ACTION AREA

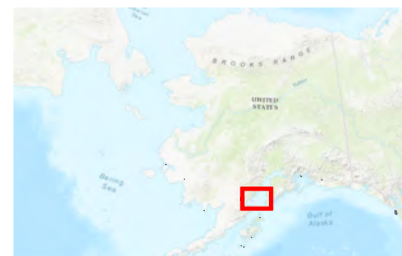
NMFS Biological Assessment

File: PLP048	Date: 12/14/2018
Revision: 10	Author: RC/OR



THE pebble PARTNERSHIP

Humpback Whale



Miles

0 5 10 15 20

Scale 1:850,000

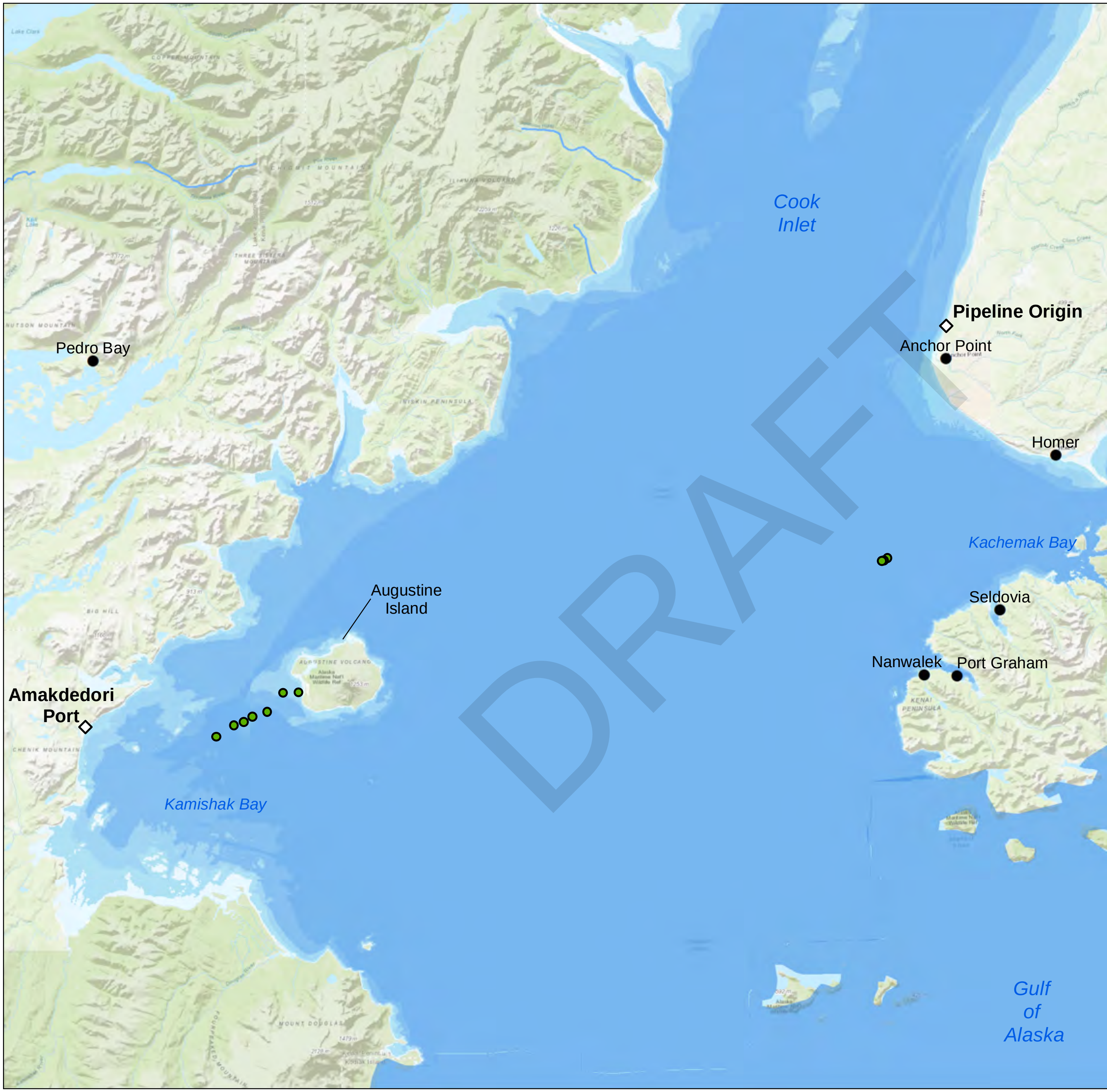
NAD 1983 StatePlane Alaska 5 FIPS 5005 Feet Seward Meridian

Figure: **9**

HUMPBACK WHALE LOCATIONS FROM NMFS SURVEYS 1993-2016

NMFS Biological Assessment

File: PLP137	Date: 12/13/2018
Revision: 00	Author: RC/OR



THE pebble PARTNERSHIP

Humpback Whale

Miles
0 5 10 15 20
Scale 1:850,000

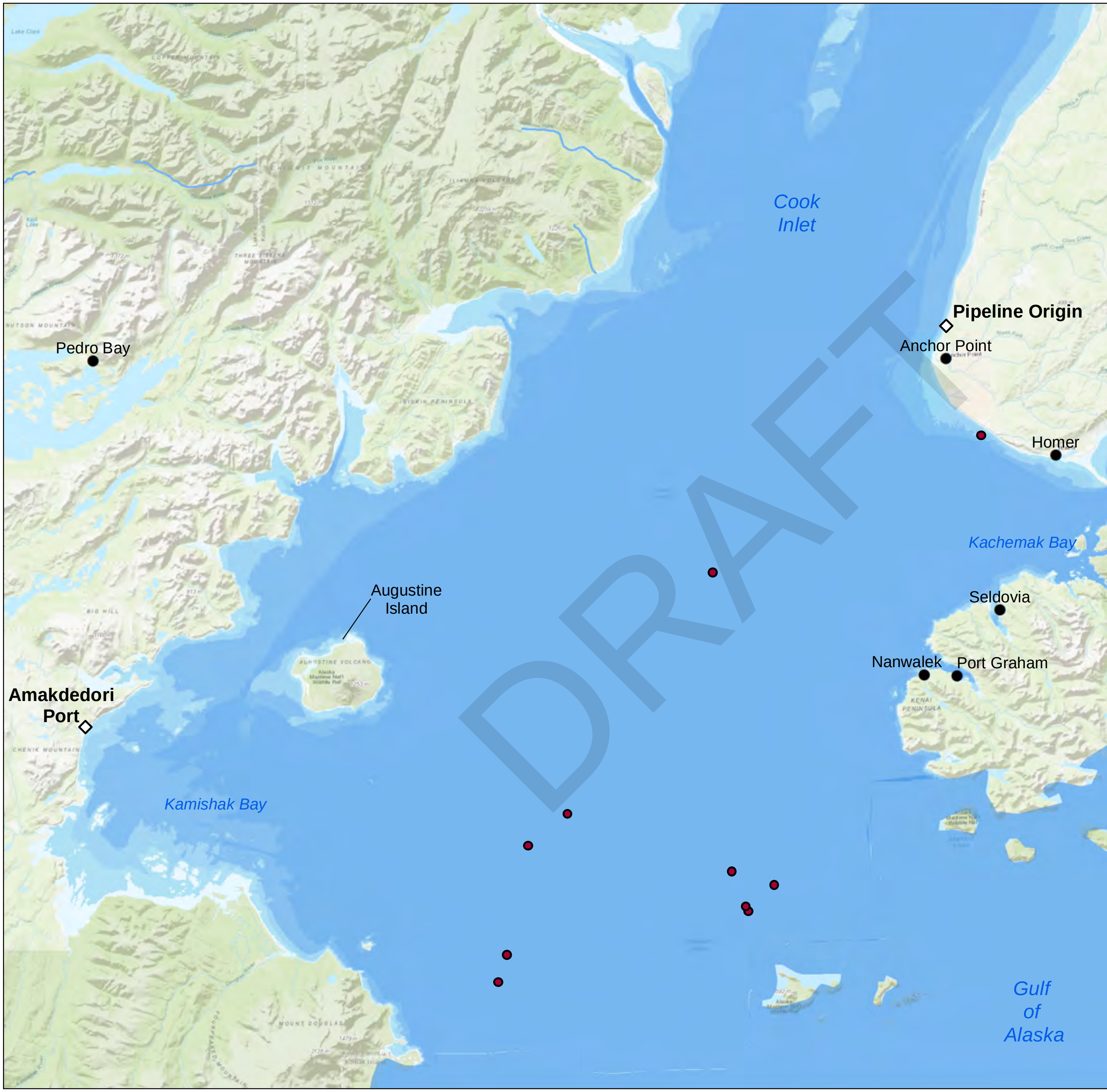
NAD 1983 StatePlane Alaska 5 FIPS 5005 Feet Seward Meridian

Figure: **10**

HUMPBACK WHALE LOCATIONS FROM ABR SURVEYS 2018

NMFS Biological Assessment

File: PLP138	Date: 12/13/2018
Revision: 00	Author: RC/OR



THE pebble PARTNERSHIP

Fin Whale

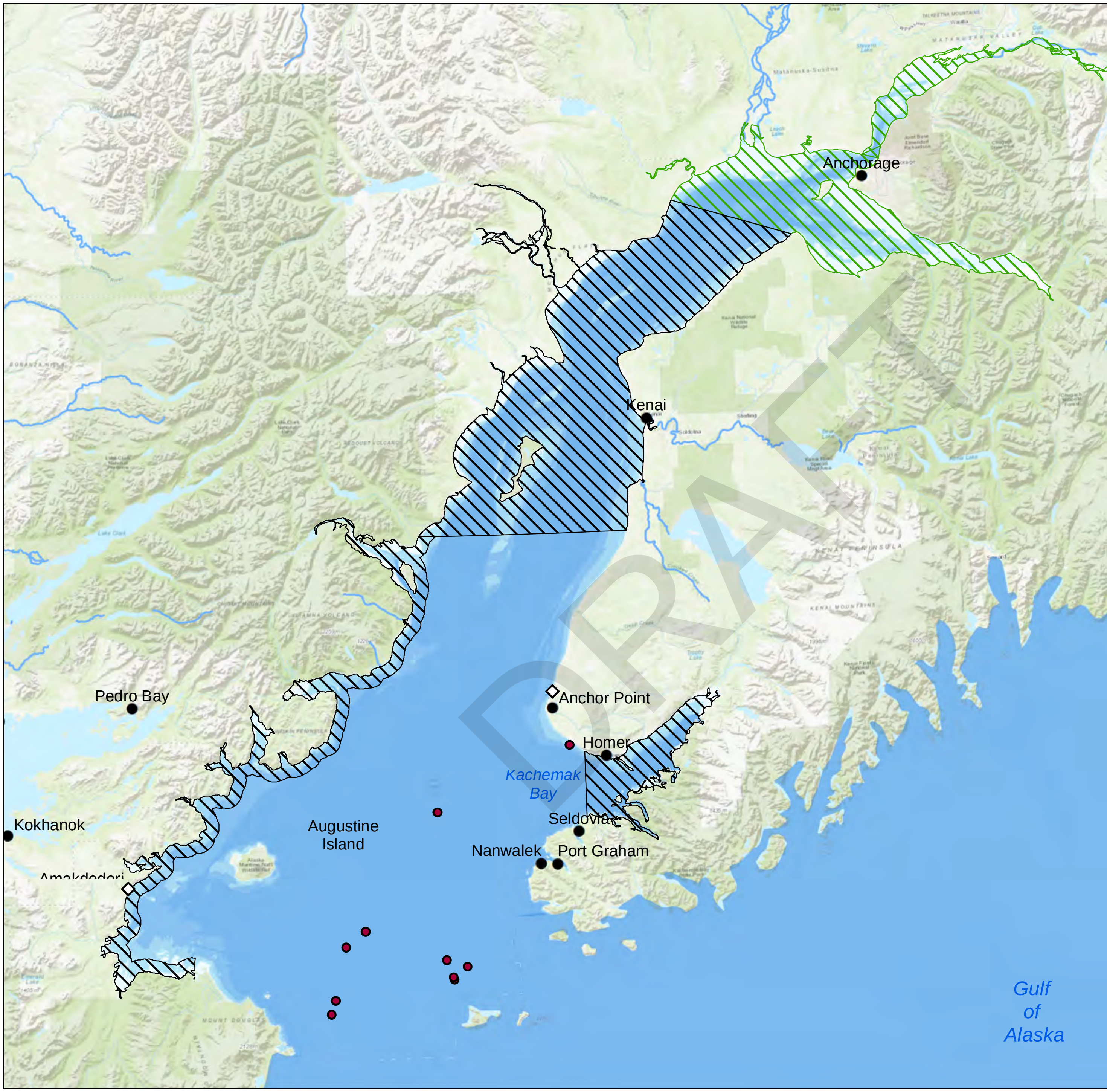
Miles
0 5 10 15 20
Scale 1:850,000

NAD 1983 StatePlane Alaska 5 FIPS 5005 Feet Seward Meridian	Figure: **11**

FIN WHALE LOCATIONS FROM NMFS SURVEYS 1993-2016

NMFS Biological Assessment

File: PLP139	Date: 12/13/2018
Revision: 00	Author: RC/OR



THE pebble PARTNERSHIP

Cook Inlet Beluga Critical Habitat

Area 1

Area 2

Miles
0 10 20 30 40
Scale 1:1,725,000

NAD 1983 StatePlane Alaska 5 FIPS 5005 Feet Seward Meridian	Figure: **12**

COOK INLET BELUGA CRITICAL HABITAT

NMFS Biological Assessment

File: PLP140	Date: 12/13/2018
Revision: 00	Author: RC/OR

Steller Sea Lion Critical Habitat

Miles
0 5 10 15 20

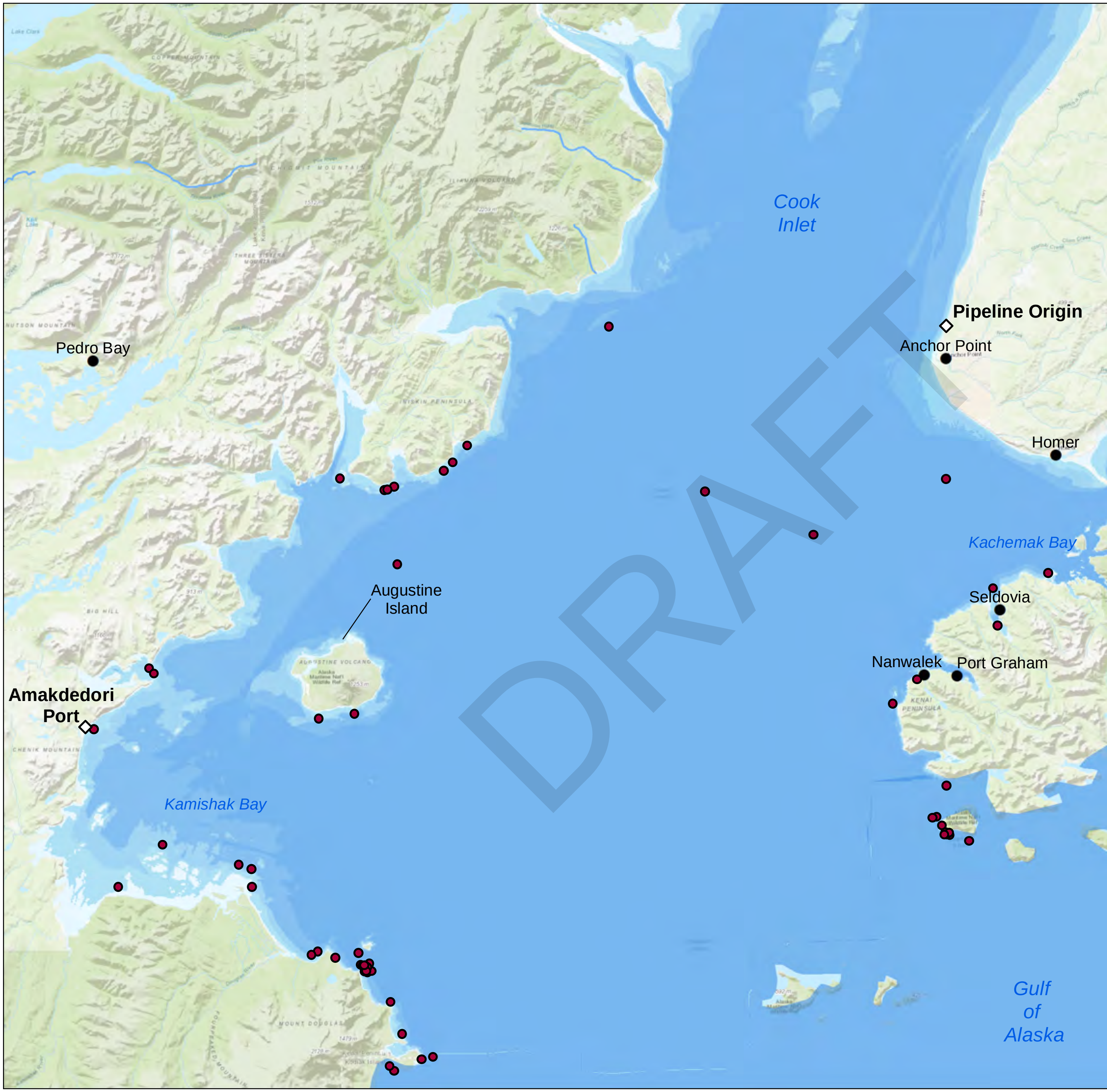
Scale 1:850,000

NAD 1983 StatePlane Alaska 5 FIPS 5005 Feet Seward Meridian	Figure: **13**

STELLER SEA LION CRITICAL HABITAT

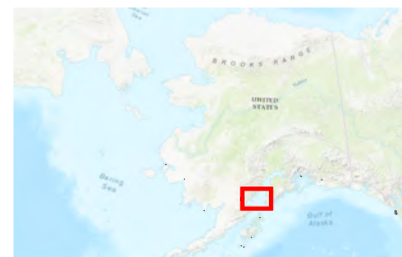
NMFS Biological Assessment

File: PLP141	Date: 12/13/2018
Revision: 00	Author: RC/OR



THE pebble PARTNERSHIP

● Steller Sea Lion



Miles

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Scale 1:850,000

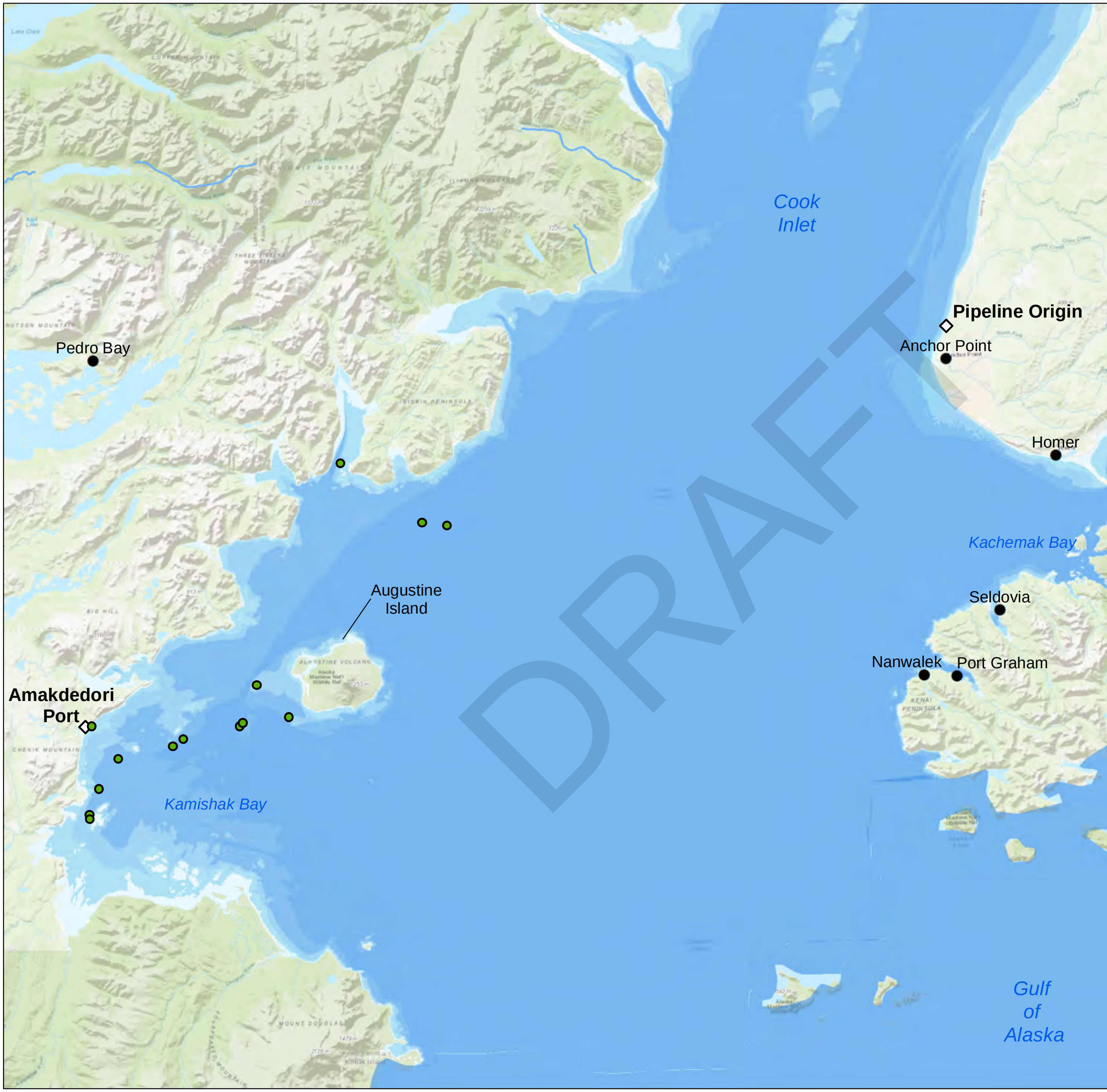
N

NAD 1983 StatePlane Alaska 5 FIPS 5005 Feet Seward Meridian	Figure: **14**

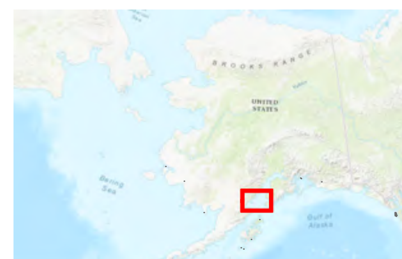
STELLER SEA LION LOCATIONS FROM NMFS SURVYES 1993-2016

NMFS Biological Assessment

File: PLP142	Date: 12/13/2018
Revision: 00	Author: RC/OR



Steller Sea Lion



Miles

0 5 10 15 20

Scale 1:850,000

NAD 1983 StatePlane Alaska 5 FIPS 5005 Feet Seward Meridian

Figure: **15**

STELLER SEA LION LOCATIONS FROM ABR SURVEYS 2018

NMFS Biological Assessment

File: PLP143	Date: 12/13/2018
Revision: 00	Author: RC/OR