

Request for Incidental Harassment Authorization (FINAL) Whittier Ferry Terminal ACF Modification

State Project No. SAMHS00228

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The environmental review, consultation, and other actions required by applicable Federal environmental laws for this project are being, or have been, carried out by DOT&PF pursuant to 23 U.S.C. 327 and a Memorandum of Understanding dated November 3, 2017 and executed by FHWA and DOT&PF.

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- A: Marine Mammal Monitoring and Mitigation Plan
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ACRONYMS AND ABBREVIATIONS

4MP	Marine Mammal Monitoring and Mitigation Plan
ACF	Alaska Class Ferry
ADEC	Alaska Department of Environmental Conservation
ADL	Alaska Division of Lands
AMHS	Alaska Marine Highway System
CV	Coefficient of variance
dB	decibel
DPS	Distinct Population Segment
DOT&PF	Alaska Department of Transportation & Public Facilities
ESA	Endangered Species Act
ESCA	Endangered Species Conservation Act
ft	feet / foot
FR	Federal Register
GPS	global positioning system
Hz	Hertz
IHA	Incidental Harassment Authorization
in	inch
k	kilometer
kHz	Kilohertz
m	meter
mi	miles
min	minutes
MMPA	Marine Mammal Protection Act
M/V	Motor vessel
nm	nautical mile
NMFS	National Marine Fisheries Service
pers. comm	personal communication
PSO	Protected Species Observer

PTS	permanent threshold shift
sec	second
SPL	sound pressure level
SSV	sound source verification
TL	transmission loss
TTS	temporary threshold shift
USACE	U.S. Army Corps of Engineers
WP&YR	White Pass & Yukon Rail

1. DESCRIPTION OF THE ACTIVITY

1.1. Purpose and Need

The State of Alaska has constructed a new Alaska Class Ferry, the *M/V Hubbard*, which is scheduled to begin operating as a day boat in Prince William Sound in summer 2020. Like its recently constructed twin sister vessel, the *M/V Tazlina*, the 280-foot *M/V Hubbard* will have a larger ship capacity and will be designed to more efficiently disembark passengers and cars. Its larger size is also expected to result in fewer cancellations of runs due to inclement winter weather. Wider than the ferries currently operating in Prince William Sound, some ferry terminals need to be modified to accommodate the *M/V Hubbard*. At Whittier, necessary modifications include moving one of the eight dolphins at the terminal approximately 1.2 meters (m) (4 feet [ft]) to widen the docking channel. Movement of the dolphin includes extracting and re-driving four 30-inch piles using both vibratory and impact hammers.

Whittier Ferry Terminal is in Prince William Sound at the head of Passage Canal (Figure 1). The marine waters of Prince William Sound are inhabited by several species of marine mammals. The Marine Mammal Protection Act of 1972 (MMPA) prohibits the take of all marine mammals, which is defined as to “harass, hunt, capture or kill, or attempt to harass, hunt, capture or kill”, except under certain circumstances. Section 101(a)(5)(D) of the MMPA allows for issuance of an Incidental Harassment Authorization (IHA), provided an activity results in negligible impacts to marine mammals and would not adversely affect subsistence use of these animals. The pile-driving portion of the project may result in marine mammals protected under the MMPA being exposed to sound levels above allowable harassment or non-serious injury thresholds. Thus, the Alaska Department of Transportation & Public Facilities (DOT&PF) is submitting this request for an IHA to the National Marine Fisheries Service (NMFS) authorizing acoustical harassment take of a limited number of marine mammals falling under NMFS jurisdiction.

In addition, marine mammals currently listed as threatened or endangered under the Endangered Species Act of 1973 (ESA) inhabit Prince William Sound, and might be present in Passage Canal during pile driving activities. Sufficient information on ESA-listed species use of the Action Area is provided in this document to facilitate NMFS’ internal MMPA/ESA consultation.

1.2. Project Description

The proposed project would use a vibratory hammer to extract the four 30-inch piles, each 39.6 m (130 ft) in length, comprising dolphin S3 at the Whittier Ferry Terminal (Figure 2 and Figure 3) and then reinstall them at a new location approximately 1.2 m (4 ft) southeast of the existing location using the same vibratory hammer. Each pile will then be proofed with an impact hammer to achieve a final depth of approximately 19.8 m (65 ft) into the seafloor. Additional construction components include modifying the existing catwalk and landing and modifying the bridge girder connection. These ancillary actions occur above water and do not produce underwater sound levels of concern.

2. DATES, DURATION, AND REGION OF ACTIVITY

2.1. Dates and Duration

The project, including mobilization and demobilization, is planned to occur during February and March 2020. Actual pile extraction and reinstallation will occur over approximately two, three-day periods, or six days total, within a two-month work-window. Table 1 provides duration details for each phase (extraction and reinstallation) of the project. The amount of pile driving occurring within a given day ranges from 30 minutes (extracting one pile) to a maximum 150 minutes (reinstalling two piles).

Table 1. Pile extraction and reinstallation time components.

Pile Type	No. of Piles	Vibratory Duration	Impact Duration	Strike Duration	Total Hours	Average Piles per Day	Days of Removal or Reinstallation
Pile Extraction							
30-in steel	4	30 min	N/A	N/A	2	1.5	3
Pile Reinstallation							
30-in steel	4	45 min	30 min (400 strikes)	0.075 sec ¹	3	1.5	3
Total	8	300 min	120 min (1600 strikes)		5		6

1. From Laughlin (2005).

2.2. Region of Activity

The proposed activities will occur at the Whittier Ferry Terminal located at the head of Passage Canal (Figure 1), a deep-water fjord within Prince William Sound. Because Whittier is connected to the Alaska Highway System via the Portage Glacier Highway and Anton Anderson Memorial Tunnel, it is a port of call for cruise ships and a popular destination for sport fisherman, tourists, and outdoor enthusiasts. It is also the marine hub of the only road system connecting Anchorage with Prince William Sound.

The dolphin proposed to be moved, S3, is located on state submerged land (ADL 23147) at 60.777°N, 148.683°W in water an average depth of 9.1 m (30 ft). Tide heights at the terminal during February and March range from approximately -0.9 to 4.6 m (-3 to 15 ft). Depending on tide, the catwalk connecting the dolphins is raised 9.1 to 12.2 m (30 to 40 ft) above the water.

Passage Canal itself is a deep (to nearly 244 m [800 ft]) fjord approximately 9.7 kilometers (km) (6 miles [mi]) long and 2.4 km (1.5 mi) wide. Several streams feed into the waterway including meltwater streams emanating from Learnard, Shakespeare, and Whittier glaciers. Tidal energy limits the production of nearshore kelps (e.g., *Fucus*) and eelgrass (*Zostera marina*) (U.S. Army Corps of Engineers [USACE] 2015), and most marine invertebrates present are hard-bottom habitat species such as mussels, barnacles, limpets, chitons, and snails (USACE 2015). Pacific herring (*Clupea pallasii*) is seasonally present at the head of the Passage Canal and appears to be the dominate fish found in the project area (USACE 2015), although major herring spawning areas within Prince William Sound are well outside Passage Canal

(Alaska Department of Environmental Conservation [ADEC] 2005). Returning hatchery king salmon (*Oncorhynchus tshawytscha*) are also found in Passage Canal mid-May to mid-June, while native silver salmon (*O. kisutch*) runs are found mid-July through late August. Passage Canal supports the largest colony of black-legged kittiwakes (*Rissa tridactyla*) in Prince William Sound (located 2.4 km [1.5 mi] north of the terminal).

3. SPECIES AND NUMBER OF MARINE MAMMALS

Marine mammal species, stocks, or distinct population segments (DPSs) known to occur in Prince William Sound are listed in Table 2. No systematic surveys for marine mammals have occurred in Passage Canal, and not all species in Table 2 have recently been recorded in Passage Canal but are addressed in this IHA request to ensure consideration of presence. Species for which incidental harassment authorization is requested are discussed in Section 6. Our understanding of presence (addressed in detail in Section 4) is based on the observations by whale watching charters based out of Whittier, which specifically search for marine mammals in Passage Canal and one of which operates during the February and March construction window.

Four populations of marine mammals listed under the ESA could potentially occur in Prince William Sound: the Mexico DPS and Western North Pacific DPS of humpback whales, the fin whale, and the Western DPS of Steller sea lions. DPSs are discrete populations as defined under the ESA, while “stocks” are demographically independent populations as defined under the MMPA. DPSs and stocks do not necessarily align. Fin whale populations have not been listed at the distinct population segment level, although such designations are under consideration (NMFS 2019).

The two listed DPSs of humpback whales represent only a fraction of the population seasonally inhabiting the Gulf of Alaska. Wade et al (2016) concluded the majority (89%) of whales inhabiting the Gulf are from the delisted Hawaii DPS, while only 10.5 percent are from the Mexico DPS and 0.5 percent from the Western North Pacific DPS, based on photo-identification.

Critical habitat has not been designated for humpback whales or fin whales, and while Steller sea lion critical habitat has been designated for most of Prince William Sound, there is no sea lion critical habitat in the Action Area (defined as the maximum Level B ensouification area; see Section 6).

Table 2. Marine mammal species, stocks, and distinct population segments (DPS) occurring within Prince William Sound.

Species	Estimated Abundance ¹ (Stock)	MMPA Status	ESA Status (DPS)	Seasonal Occurrence in Action Area ²
Humpback Whale³ <i>(Megaptera novaeangliae)</i>	10,103 (Central North Pacific)	Depleted, Strategic Stock	Delisted in 2016 (Hawaii DPS)	Rare
	1,918 (California/Washington/ Oregon)		Threatened (Mexico DPS)	Not Confirmed
	1,107 (Western North Pacific)		Endangered (Western North Pacific DPS)	Not Confirmed
Fin Whale <i>(Balaenoptera physalus)</i>	3,168 (Northeast Pacific)	Depleted, Strategic Stock	Endangered	Not Observed
Minke Whale <i>(Balaenoptera acutorostr)</i>	Unknown	Protected, Nonstrategic Stock	Not Listed	Not Observed

Species	Estimated Abundance ¹ (Stock)	MMPA Status	ESA Status (DPS)	Seasonal Occurrence in Action Area ²
Gray Whale (<i>Eschrichtius robustus</i>)	20,990 (Eastern North Pacific)	Protected, Nonstrategic Stock	Not Listed	Not Observed
Killer Whale (<i>Orcinus orca</i>)	2,347 (Eastern North Pacific, Alaska Resident)	Protected, Nonstrategic Stock	Not Listed	Rare
	587 (Gulf, Aleutian, Bering Transient)			
	7 (AT1 Transient)	Depleted, Strategic Stock		
Pacific White-sided Dolphin (<i>Lagenorhynchus obliquidens</i>)	26,880 (North Pacific)	Protected, Nonstrategic Stock	Not Listed	Not Observed
Dall's Porpoise (<i>Phocoenoides dalli</i>)	83,400 (Alaska)	Protected, Nonstrategic Stock	Not Listed	Not Observed
Harbor Porpoise (<i>Phocoena phocoena</i>)	31,046 (Gulf of Alaska)	Protected, Strategic Stock	Not Listed	Not Observed
Steller Sea Lion² (<i>Eumetopias jubatus</i>)	53,303 (Western U.S.)	Depleted, Strategic Stock	Endangered (Western DPS)	Infrequent
Harbor Seal (<i>Phoca vitulina</i>)	29,889 (Prince William Sound)	Protected, Nonstrategic Stock	Not Listed	Infrequent

1. Abundance estimates are from the most recent published stock reports (Carretta et al. 2018, Muto et al. 2018).

2. Seasonal Occurrence – Rare: Few confirmed sightings but not annually. Infrequent: Confirmed, but irregular sightings. Not Confirmed: The species has been reported in Action Area but the stock or DPS has not been confirmed. Not Observed: The species has not been observed within the Action Area during at least two decades of whale watching tours.

3. Humpback whales and Steller sea lions are discussed in terms of the distinct population segments (DPS) in the following sections to better quantify the effects to the endangered population segments.

4. AFFECTED SPECIES STATUS AND DISTRIBUTION

4.1. Humpback Whale (*Megaptera novaeangliae*)

4.1.1. Status

In 1970, the humpback whale was listed as endangered under the Endangered Species Conservation Act (ESCA) (35 FR 18319). In 1973, Congress replaced the ESCA with the Endangered Species Act (ESA), and humpback whales continued to be listed as endangered. Because humpback numbers subsequently increased across much of their range, NMFS conducted a global status review and reassessed the status of humpback whales under the ESA (Bettridge et al. 2015). Based on that review, 14 DPSs of humpback whales were identified, and listings revised as appropriate (81 FR 62260).

In the North Pacific, five DPSs that breed in subtropical and tropical waters from Asia to Central America then migrate north to feed in highly productive North Pacific feeding grounds were identified (Bettridge et al. 2015). Whales from three of these DPSs migrate to Alaskan waters: the Mexico DPS (ESA-listed as threatened), the Western North Pacific DPS (ESA-listed as endangered), and the Hawaii DPS (delisted) (81 FR 62260).

4.1.1.1. Distribution

The humpback whale is distributed worldwide in all ocean basins. Relatively high densities of humpback whales are found in feeding grounds in Southeast Alaska and northern British Columbia, particularly during summer months. Based on extensive photo identification data, NMFS has determined that individual humpback whales encountered in the Gulf of Alaska have a 89 percent probability of being from the recovered (delisted) Hawaii DPS, a 10.5 percent probability of being from the currently threatened (ESA-listed) Mexico DPS, and 0.5 percent from the endangered Western North Pacific DPS (Wade et al. 2016). Intermixed DPSs are not visually distinguishable; their identity can only be determined by DNA or photo identification. Therefore, we will use Wade et al. (2016) estimates that assume that there is an 89 percent chance that the humpbacks that have been observed on rare occasions in Passage Canal are from the recently delisted Hawaii DPS.

Humpbacks migrate to Alaska to feed after months of fasting in low latitude breeding grounds. The timing of migration varies among individuals: most humpbacks begin returning to Alaska in spring and most depart Alaska for southern breeding grounds in fall or winter. Peak numbers of humpbacks in Southeast Alaska occur during late summer to early fall, but because there is significant overlap between departing and returning whales, humpbacks can be found in Alaska feeding grounds in every month of the year (Baker et al. 1985, Straley 1990, Witteveen and Wynne 2017). There is also an apparent increase in the number of humpbacks overwintering in feeding grounds in Alaska (Straley et al. 2018).

Humpback whale individuals of different DPS (natal) origin are indistinguishable from one another (unless fluke patterns are linked to the individual in both feeding and breeding ground). The frequency of occurrence of animals by DPS provided in this IHA application is only an *estimate* and is based on the DPS ratio and the assumption that the ratio is consistent throughout the Gulf of Alaska including Prince William Sound (Wade et al. 2016).

4.1.1.2. Hawaii Distinct Population Segment (Hawaii DPS)

Humpbacks that breed around the main Hawaiian Islands have been observed in summer feeding grounds throughout the North Pacific. Most of the Hawaii DPS migrates to feeding grounds in the Gulf of Alaska (Bettridge et al. 2015). Mark-recapture analysis of identification photographs suggests the Hawaii DPS numbers approximately 10,103 individuals and is increasing (Calambokidis et al. 2008). A multi-strata analysis estimated the abundance of the Hawaii DPS as 11,398 individuals (coefficient of variance [CV]=0.04) (81 FR 62260). As mentioned above, Wade et al. (2016) estimated that 89 percent of the humpbacks encountered in the Gulf of Alaska are from the Hawaii DPS.

4.1.1.3. Mexico Distinct Population Segment (Mexico DPS)

Whales in the Mexico DPS typically breed off the Revillagigedo Islands in Mexico and migrate to northern feeding grounds ranging from British Columbia to the western Gulf of Alaska. Given their widespread range and their opportunistic foraging strategies, Mexico DPS humpback whales might occur in the Gulf of Alaska during the proposed project activities. In the final rule changing the status of humpback whales under the ESA (81 FR 62260), the abundance of the Mexico DPS was estimated to be 3,264 individuals (CV= 0.06) with an unknown trend. Note that only a portion of the Mexico DPS migrates to Alaska for feeding; the probability that a whale encountered in the Passage Canal Action Area is from the Mexico DPS is, again, 10.5 percent (Wade et al. 2016). Also, a large portion of the Mexico DPS include members of the California/Oregon/Washington stock, but it is unclear whether any members of the stock seasonally inhabit the Gulf of Alaska. This “stock” may not be present in the Gulf.

4.1.1.4. Western North Pacific Distinct Population Segment (WNP DPS)

The Western North Pacific stock 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 this and other North Pacific stocks (Wade et al. 2016). NMFS has provided humpback whale guidance indicating that individuals from all three of the above stocks, can occur in the Gulf of Alaska summer feeding grounds, but only 0.5 percent were from the Western North Pacific DPS based on Wade et al. (2016).

4.1.1.5. Presence, Abundance, and Seasonality in the Action Area

Based on over two decades of whale watching activity in Passage Canal, humpback whales have been observed in Passage Canal on only very rare occasions and remained for very short periods (M. Bender, Lazy Otter Charters, pers. comm.). Reported occurrence is approximately once per year (M. Kopeck, Whittier Marine Charters, pers. comm.). Passage Canal probably does not have the prey resources to attract and/or hold humpback whales.

4.1.1.6. Critical Habitat

No critical habitat has been designated for the humpback whale in Alaskan waters.

4.1.2. Reproduction and Breeding

During the winter months most humpback whales make a long annual migration to the low-latitude subtropical and tropical waters to breed and calve. Humpback whales do not breed or calve in Alaska waters and individuals of the Hawaii DPS primarily migrate to Hawaii for breeding and calving (Muto et al. 2018), while Mexico DPS whales breed in Mexican waters, and the Western North Pacific DPS off Japan.

4.1.3. Foraging

While in their Alaskan feeding grounds, humpback whales prey on a variety of euphausiids and small schooling fishes including Pacific herring (*Clupea pallasii*), longfin smelt (*Spirinchus thaleichthys*), capelin (*Mallotus villosus*), Pacific sand lance (*Ammodytes hexapterus*), juvenile walleye pollock (*Theragra chalcogramma*), and salmon (*Oncorhynchus* spp.) smolts (Nemoto 1957, Kawamura 1980, Krieger and Wing 1986, Witteveen et al. 2008, Straley et al. 2018, Chenoweth et al. 2017).

The local distribution of humpbacks in the Prince William Sound appears to be correlated with the density and seasonal availability of prey, particularly herring and euphausiids (Straley et al. 2018). Important feeding areas in Prince William Sound include Montague Strait, Port Bainbridge, and Port Gravina, all major herring spawning areas (ADEC 2005, Moran et al. 2017). Straley et al. (2018) estimated the number of humpback whales that extended their seasonal stay in Prince William Sound into the winter months as 64 whales in 2007/2008 and 135 whales in 2008/2009, with four whales skipping the migration to winter grounds altogether.

Fidelity to feeding grounds by individual humpbacks is well documented; interchange between Alaskan feeding grounds is rare (Witteveen and Wynne 2017). Long-term research and photo-identification efforts have documented individual humpbacks that have returned to the same feeding grounds for as many 45 years (Straley et al. 2018, Witteveen and Wynne 2017, Gabriele et al. 2017).

4.1.4. Acoustic Ecology

Humpback whales live in an acoustic world. Humpbacks produce a variety of vocalizations ranging from 20 Hz to 10 kHz to locate prey, coordinate communal feeding efforts, attract mates, and for mother-calf communication (Au et al. 2006, 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 (Southall et al. 2007). 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). Humpback whales use singing as a form of underwater communication at their wintering grounds for mating and seasonally at feeding grounds, like the Aleutian Islands (Fleming and Jackson 2011). Loud underwater noises, such as those from seismic surveys and pile driving, can result in humpback whales adjusting their acoustic behavior in ways like altering song length (Fleming and Jackson 2011).

4.2. Fin Whale (*Balaenoptera physalus*)

4.2.1. 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 recovery plan was developed in 1998.

Prior to commercial whaling, an estimated 25,000 to 27,000 fin whales seasonally inhabited the eastern North Pacific (Ohsumi 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. The current abundance estimate for this stock is 3,168 based on 2013 Gulf of Alaska survey conducted by Rone et al. (2017). Uncertainties in previous population estimates make it difficult to estimate current population trends other than the population appears to have been increasing since at least the 1980s (Muto et al. 2018).

4.2.2. Distribution

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).

4.2.2.1. Presence, Abundance, and Seasonality in the Action Area

Fin whales annually concentrate at the entrance to Prince William Sound including Hinchinbrook Entrance and Montague Strait (Consiglieri et al. 1982), and prefer these deeper waters than the shallow, more inland waters of the sound. Occurrence in the Action Area is unlikely as there are but one record of a fin whale occurring within Passage Canal in the past 20 years (M. Kopec, Whittier Marine Charters, pers. comm.), and occurrence is further unlikely given that seasonal fin whale arrival in the Gulf of Alaska usually does not begin until May, well after the February and March work window.

4.2.3. Reproduction and Breeding

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).

4.2.4. Foraging

Fin whales feed primarily on krill and schooling fish such as anchovies, Pacific herring, and walleye pollock (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).

4.2.5. Acoustic Ecology

Fin whales produce a variety of low-frequency vocalizations (Stimpert et al. 2015) with some that can be detected hundreds of kilometers away (Sirovic et al. 2007). The most common call is a 20 Hz pulse of approximately 1 second thought to be used as a long-distance contact call (Watkins et al. 1987, McDonald and Fox 1999, Sirovic et al. 2013). A higher 70 to 40 Hz downsweep call has been recorded in the summer during feeding bouts (Watkins 1981, Sirovic et al. 2013).

As with all mysticetes, fin whales are categorized in the low-frequency cetacean functional hearing group, with an applied frequency range between 7 Hz and 35 kHz (Southall et al. 2007).

4.3. Minke Whale (*Balaenoptera acutorostr*)

4.3.1. Status

The minke whale is protected under the MMPA but is not listed as a strategic or depleted species. Minke whales are also not listed as threatened or endangered under the ESA, although no Alaska abundance estimates are available for minke whales (Muto et al. 2018). The minke whale population status is considered stable and they are the most abundant rorqual, or “great whale”, in the world (NMFS 2018a).

4.3.2. Distribution

Minke whales are widely distributed throughout the northern hemisphere and are found in both the Pacific and Atlantic oceans. Minke whales in Alaska are considered migratory and during summer months are typically found in the Arctic and during winter months are found near the equator (NMFS 2018a).

4.3.2.1. Presence, Abundance, and Seasonality in the Action Area

In the past 20 years, marine mammal charter operators have seen but a very few (<5 animals) minke whales within Passage Canal (M. Bender, Lazy Otter Charters, pers. comm.; M. Kopec, Whittier Marine Charters, pers. comm.).

4.3.3. Reproduction and Breeding

Minke whales are believed to calve in the winter months (NMFS 2018a), however little is known about their breeding areas.

4.3.4. Foraging

Minke whales feed by side-lunging through schools of prey and are opportunistic predators feeding on a variety of crustaceans, plankton, and small school fish (NMFS 2018a).

4.3.5. Acoustic Ecology

Different worldwide populations of minke whales produce different vocalizations to the point of recognizing these populations as separate species. North Atlantic whales produce grunts or thump pulses, Antarctic minke whales a “quack-like” sound called bio-duck, and dwarf Antarctic whales a complex set of vocalizations called “star-wars” (Risch et al. 2013, 2014a, 2014b). North Pacific whales produce a sound called the “boing” consisting of a brief pulse at 1.3 kHz, followed by a 2.5 second call at 1.4 kHz (Rankin and Barlow 2005, Oswald et al. 2011).

Minke whales have a generalized hearing range of 7 Hz to 35 kHz and fall under the Low-frequency Cetacean hearing group (Southall et al. 2007).

4.4. Gray Whale (*Eschrichtius robustus*)

4.4.1. Status

The Eastern North Pacific (or California) gray whale is one of two stocks inhabiting the Pacific Ocean (the other is the Endangered western North Pacific [or Korean] stock found along the Asian coast). The Eastern North Pacific stock of the gray whale was removed from the Endangered Species List in 1994 (59 FR 31094), while the Western North Pacific stock includes only about 200 individuals (Weller et al. 2002) and is listed as endangered under the ESA.

Bradford et al. (2003) modeled the population parameters of the Western North Pacific stock of gray whale and estimated that the current population is only 8 percent to 9 percent of the original population but does appear to be growing at or near its biologically maximum rate. This stock winters off Korea and southern Japan and summers in the Sea of Okhotsk or vicinity (Weller et al. 2002).

4.4.2. Distribution

The eastern North Pacific stock breeds in the warm-water lagoons of coastal Baja California and Mexico and winters in the shelf waters of the Bering and Chukchi seas (Jones et al. 1984), completing each year an annual round-trip migration of 16,000 to 22,500 km (9,900 to 14,000 mi). Not all whales complete the migration as some whales feed in the coastal waters of the Pacific Northwest (Calambokidis et al. 2002, 2010), and possibly elsewhere along the migration route.

4.4.2.1. Presence, Abundance, and Seasonality in the Action Area

Gray whales annually pass by the outlet of Prince William Sound during the annual migration to and from summer feeding grounds in the Bering and Chukchi seas. However, they do not regularly enter Prince William Sound and they have been observed in Passage Canal by charter operators only twice in the past 20 years (M. Bender, Lazy Otter Charters, pers. comm.; M. Kopec, Whittier Marine Charters, pers. comm.).

4.4.3. Reproduction and Breeding

Both male and female gray whales become sexually mature at about 8 years of age. Both sexes are promiscuous and copulate frequently with multiple partners (Jones and Swartz 1984). Conception is largely restricted to late November to early January (Swartz et al. 2006), and gestation is about 13 months (Rice and Wolman 1971) followed by a 6- to 7-month period before calves are weaned (Swartz et al. 2006). After

weaning, females remain anestrus until late fall when once again they become receptive to pregnancy and enter another 2-year breeding cycle (Rice and Wolman 1971).

4.4.4. Foraging

Gray whales typically do not feed during their northward migration through Alaskan waters until they reach the Chukchi Sea where they spend the summer feeding mostly on amphipods, a benthic crustacean (Rice and Wolman 1971, Highsmith and Coyle 1992, Nelson et al. 1994). However, small groups of whales may opportunistically feed along route (Nerini 1984), with some groups becoming “resident” at areas of high localized prey densities (Calambokidis et al. 2004). One “resident” group, known as the Kodiak group, has been observed year-round at Ugak Bay (Kodiak Island) feeding on dense populations of hopped shrimp or cumaceans (Diastylidae), a benthic crustacean (Moore et al. 2007). There is no evidence of gray whales feeding for prolonged periods in Prince William Sound although some whales apparently stop and feed in nearby Resurrection Bay.

4.4.5. Acoustic Ecology

Gray whales are relatively sonorous during migration producing a variety of low-frequency moans, knocks, and rumbles (Burnham et al. 2018). While calls in the breeding lagoons, often associated with communicating with neonates, extend to 2 kHz (Dahlheim 1987), the various calls recorded during migration range largely from about 30 Hz to 500 Hz. Calls are directly measurable but hearing in gray whales is not and is usually estimated based on vocalization, response to sounds, and anatomy. Mysticetes in general most likely hear best between tens of hertz to about 10 kHz, although some may be able to hear sound extending to 30 kHz (Ketten et al. 2007). Regardless, gray whales fall with the low-frequency functional group identified by Southall et al. (2007) with best hearing between 7 Hz and 22 kHz.

4.5. Killer Whale (*Orcinus orca*)

4.5.1. Status

NMFS considers three stocks of killer whales to seasonally inhabit Prince William Sound. These stocks are the Eastern North Pacific Alaska Resident stock (2,347 individuals), the Gulf of Alaska, Aleutian Islands, and Bering Sea Transient Stock (587 individuals), and the small AT1 Transient Stock (7 individuals) (Muto et al. 2018). These stocks represent two of the three ecotypes of killer whales occurring within the North Pacific Ocean – resident (forages on fish) and transient (forages primarily on marine mammals). However, NMFS is evaluating new genetic information that will likely result in a revision of the above stock structure (Muto et al. 2018). The killer whale is protected under the MMPA, but none of these stocks are listed as a strategic or depleted species under the MMPA nor is it listed as threatened or endangered under the ESA.

4.5.2. Distribution

Killer whales are found in every ocean of the world (NMFS 2018b) and are the most widely distributed marine mammal (Leatherwood and Dahlheim 1978).

4.5.2.1. Presence, Abundance, and Seasonality in the Action Area

On rare occasions killer whales have been reported to make brief sorties into Passage Canal, but they are not a regular resident there (M. Bender, Lazy Otter Charters, pers. comm.). They are seen in the inlet approximately once each year (M. Kopec, Whittier Marine Charters, pers. comm.).

4.5.3. Reproduction and Breeding

Killer whales do not have a distinct breeding season and their birthing rate is not well understood; however, it is estimated that killer whales will give birth once every five years (NMFS 2018b).

4.5.4. Foraging

Killer whales have no natural predators and are known as the top carnivores currently living on the Earth (Pitman 2011). The species has the most varied diet of all cetaceans; however, the transient populations typically hunt marine mammals while the resident populations feed on fish, particularly salmon and Atka mackerel (Barrett-Lennard et al. 2011, Parsons et al. 2013). Residents often travel in much larger and closer groups than transients and have been observed sharing fish they catch. Transient killer whales feed on other marine mammals including Steller sea lions, harbor seals, and various species of cetaceans. They are also more likely to rely on stealth, making less frequent and less conspicuous calls and skirting “along shorelines and around headlands” in order to hunt their prey in highly coordinated attacks (Barrett-Lennard et al. 2011).

4.5.5. Acoustic Ecology

Killer whales rely on underwater sound for a variety of reasons including navigation, feeding, and communication. Killer whales use echolocation to assist with food gathering — transient killer whales use it rarely and most likely for hunting, while resident whales use it to locate salmon (Au et al. 2004). Killer whale social signals resemble the sound of mid-range tactical sonar (Southall et al. 2007), with signals commonly occurring as pulsed calls, whistles, and clicks (Szymanski et al. 1999). Increases in noise levels near killer whale habitat, like that associated with increasing vessel traffic, have been found to result in an increase in the duration of killer whale calls (Foote et al. 2004 as cited in Southall et al. 2007). Killer whales are part of the mid-frequency cetacean functional hearing group, with their estimated auditory bandwidth between 150 Hz and 160 kHz (Southall et al. 2007).

4.6. Pacific White-sided Dolphin (*Lagenorhynchus obliquidens*)

4.6.1. Status

Pacific white-sided dolphins are not designated as depleted or classified as strategic under the MMPA, nor are they listed under the ESA. There are no recent reports of injurious interaction with commercial fisheries or other human activity in Alaska and population trends are unknown (Muto et al. 2018).

4.6.2. Distribution

NMFS recognizes two stocks of Pacific white-sided dolphin in the eastern North Pacific: a California/Oregon/Washington stock and a North Pacific stock (Muto et al. 2018). There is not enough genetic separation of the stocks to support phylogeographical partitioning other than the generalization of

a northern form and a southern form, but there is enough differentiation in the populations and in the management of the regions they inhabit to warrant separate management units (Lux et al. 1997). The North Pacific management stock ranges across the Gulf of Alaska from Vancouver Island to the Aleutian Islands (Muto et al. 2018).

4.6.2.1. Presence, Abundance, Seasonality in the Action Area

According to Leatherwood et al. (1984) Pacific white-sided dolphins can be found in the inland waters of Washington, British Columbia, and Southeast Alaska, but do not regularly penetrate Prince William Sound. Extensive marine mammal surveys conducted within the sound by Hall (1979) and Waite (2003) yielded no sightings of Pacific white-sided dolphins. Based on habitat preferences and past survey results, this dolphin is unlikely to occur in the Action Area, especially given the early spring work-window. Over the last 20 years, none have been observed in the inlet by charter operators (M. Bender, Lazy Otter Charters, pers. comm.; M. Kopec, Whittier Marine Charters, pers. comm.).

4.6.3. Reproduction and Breeding

Pacific white-sided dolphins reach sexual maturity from 7.5 to 11 years of age (Ferrero and Walker 1996, Heise 1997a). These dolphins exhibit distinct reproduction seasonality with conception of animals inhabiting the North Pacific occurring during the summer months followed by a 11- to 12-month gestation (Ferrero et al. 1993, Robeck et al. 2009).

4.6.4. Foraging

Diet is dependent on region. Off California, Pacific white-sided dolphins feed largely on lantern fish, anchovies, hake, and squid (Fitch and Brownell 1968), while off British Columbia important prey include herring, salmon, cod (*Gadus macrocephalus*), shrimp, and capelin (Heise 1997b). Based on prey availability, diet in Alaskan waters is probably similar to those off British Columbia.

4.6.5. Acoustic Ecology

Pacific white-sided dolphins produce echolocation clicks that range in frequency from 20 to over 100 kHz (Henderson et al. 2011), but also produce burst pulses and buzzes used both for foraging and communication (Lammers et al. 2003). Click frequency peaks may vary by stock (Soldevilla et al. 2008) and vocalization type correlates with behavior such as foraging, travel, or sociality (Henderson et al. 2011). Tremel et al. (1998) measured the hearing sensitivity of a captive Pacific white-sided dolphin and found best sensitivity between 2 kHz and 128 kHz. Pacific white-side dolphins fall within Southall et al.'s (2007) mid-frequency (150 Hz to 160 kHz) functional hearing group.

4.7. Dall's Porpoise (*Phocoenoides dalli*)

4.7.1. Status

The Dall's porpoise is not designated as depleted or classified as strategic under the MMPA, nor are they listed under the ESA. Only one stock of Dall's porpoise is currently recognized in Alaskan waters – the Alaska stock – with an estimated abundance of 83,400, although this estimate is outdated (Muto et al. 2018).

While the Dall's porpoise is generally considered abundant, there is insufficient data on population trends to determine whether the population is stable, increasing or decreasing (NMFS 2018c).

4.7.2. *Distribution*

Dall's porpoises are widely distributed in the North Pacific Ocean, usually in deep oceanic waters (183 m [>600 ft]), over the continental shelf or along slopes (NMFS 2018c, Muto et al. 2018). They can be found along the west coast of the United States ranging from California to the Bering Sea in Alaska (NMFS 2018c).

4.7.2.1. Presence, Abundance, and Seasonality in the Action Area

Dall's porpoises have occasionally been observed near the entrance of Passage Canal, but within the inlet they are considered exceedingly rare (M. Bender, Lazy Otter Charters, pers. comm.; M. Kopec, Whittier Marine Charters, pers. comm.).

4.7.3. *Reproduction and Breeding*

Dall's porpoises can be found in Alaskan waters year-round (Muto et al. 2018) and typically give birth between June and September to single calves (NMFS 2018b).

4.7.4. *Foraging*

Dall's porpoises feed on small schooling fish, mid- and deep-water fish, cephalopods, and crustaceans. Their prey includes anchovies, herring, hake, myctophids, smelts, squid, octopus, crabs, and shrimp (NMFS 2018c).

4.7.5. *Acoustic Ecology*

Dall's porpoises communicate through generation of clicks at the 165 to 175 kHz range and have a general hearing range between 275 Hz and 160 kHz (Southall et al. 2007). They are considered part of the high-frequency cetacean hearing group.

4.8. Harbor Porpoise (*Phocoena phocoena*)

4.8.1. *Status*

The Gulf of Alaska stock of harbor porpoise is not designated as depleted under the MMPA nor listed under the ESA but is considered strategic due to human-induced mortality (Muto et al. 2018).

4.8.2. *Distribution*

In the eastern North Pacific Ocean, the harbor porpoise ranges from Point Barrow, along the Alaska coast, and down the west coast of North America to Point Conception, California. NMFS currently acknowledges three stocks of harbor porpoise within this range (Muto et al. 2018), with the one encompassing the Action Area – the Gulf of Alaska stock – ranging from Unimak Pass to Cape Suckling. This stock is estimated to include 31,046 individuals based on a 1998 survey (Hobbs and Waite 2010).

The harbor porpoise frequents nearshore waters and coastal embayments throughout their range, including bays, harbors, estuaries, and fjords less than 198 m (650 ft) deep (NMFS 2018d).

4.8.2.1. Presence, Abundance, and Seasonality in the Action Area

Harbor porpoise have not been observed in Passage Canal during over two decades of whale watching by one charter operator (M. Bender, Lazy Otter Charters, pers. comm.), and are considered extremely rare in Passage Canal by another (M. Kopec, Whittier Marine Charters, pers. comm.).

4.8.3. Reproduction and Breeding

Harbor porpoises are believed to typically mate during summer months and give birth between May and July, however very little is known about their reproduction and breeding (NMFS 2018b).

4.8.4. Foraging

Harbor porpoises forage primarily on Pacific herring, other small schooling fish, and cephalopods and will occasionally feed on squid and octopus (NMFS 2018d). In the Gulf of Alaska, higher densities have been reported in lower Cook Inlet (Shelden et al. 2014).

4.8.5. Acoustic Ecology

Based on their hearing capacity, Harbor porpoise are in the high frequency functional hearing group, with assumed sensitivity matching sound they generate (Southall et al. 2007). Harbor porpoise' best estimated hearing ranges from 16 to 140 kHz with maximum sensitivity occurring between 100 and 140 kHz (Kastelein et al. 2005b). The peak frequency produced by harbor porpoises for echolocation is 120 to 130 kHz, which corresponds with the maximum sensitivity range.

4.9. Steller Sea Lion (*Eumetopias jubatus*)

4.9.1. Status

The Steller sea lion was listed as a threatened species under the ESA in 1990 following declines of 63 percent on certain rookeries since 1985 and declines of 82 percent since 1960 (55 FR 12645). In 1997, two DPSs of Steller sea lion were identified based on differences in genetics, distribution, phenotypic traits, and population trends (62 FR 24345, Fritz et al. 2013): the Eastern DPS found east of Cape Suckling (144°W) and the Western DPS found west of Cape Suckling. At that time the Western DPS was up-listed to endangered due to continuing declines. However, the Eastern DPS population increased and was eventually removed from the ESA listing in 2013 (78 FR 66140).

Currently, the Western DPS population is estimated at 53,303 (Muto et al. 2018), still considerably less than the 140,000 estimated to inhabit the range of this DPS in the 1960s (Merrick et al. 1987). However, there is strong evidence that this population has been increasing at a rate of over 2 percent annually since a population low in 2003, with even higher trends in the Gulf of Alaska (Sweeney et al. 2016). Significant declines (nearly 7% annually) continue in the far western (Western Aleutian Islands) end of its range.

4.9.2. Distribution

Steller sea lions range throughout the North Pacific Ocean from Japan, east to Alaska, and south to central California (Muto et al. 2018). They range north to the Bering Strait, with significant numbers at haulouts on St. Lawrence Island, Alaska in the spring and fall. Their range extends around the North Pacific Ocean rim, with most sea lions occupying either rookeries or haulouts, depending on the season. Male sea lions

are more likely to disperse beyond their typical habitat, but this primarily occurs after the breeding season (NMFS 2018e).

Members of this species are not known to migrate, but individuals disperse widely outside of the breeding season (late May to early July). At sea, Steller sea lions commonly occur near the 200-m (656-ft) depth contour but have been found from nearshore to well beyond the continental shelf (Kajimura and Loughlin 1988). Sea lions move on and offshore to pelagic waters for feeding excursions. They are also capable of traveling long distances in a season. Sea lions may make semi-permanent or permanent one-way movements from one site to another (Chumbley et al. 1997, Burkanov and Loughlin 2005). Round trip transit of greater than 6,500 km (4,040 mi) by individual Steller sea lions has been documented (Jemison et al. 2013).

Land sites used by Steller sea lions are referred to as rookeries and haulouts. Rookeries are used by adult sea lions for pupping, nursing, and mating during the reproductive season (generally from late May to early July). Haulouts are used by all age classes of both genders but are generally not where sea lions reproduce. At sea, they are seen alone or in small groups, but may gather in large "rafts" at the surface near rookeries and haulouts or foraging sites.

4.9.2.1. Presence, Abundance, and Seasonality in the Action Area

Steller sea lions are often seen near Whittier during May to August salmon runs but are irregularly seen in the Action Area the rest of the year, although as many as ten sea lions haul out year-round on a channel buoy within Shotgun Cove approximately 6 km (3.7 mi) northeast of the Action Area (Figure 4) (M. Bender, Lazy Otter Charters, pers. comm.; M. Kopec, Whittier Marine Charters, pers. comm.).

4.9.2.2. Critical Habitat

Steller sea lion critical habitat within Prince William Sound includes three major haulouts (The Needle, Perry Island, and Point Eleanor), and several more haulouts plus two rookeries (Seal Rocks and Fish Island). When including the designated 20-nautical-mile (nm) zone around each denoting critical habitat (foraging), most of Prince William Sound falls within Steller sea lion critical habitat. However, the nearest major haulout is >20 nm from the Action Area; thus, no sea lion critical habitat falls within the Action Area.

4.9.3. Reproduction and Breeding

The Steller sea lion worldwide breeding range extends along the northern edge of the Pacific Ocean from the Kuril Islands, Japan, through the Aleutian Islands and Southeast Alaska, south to California (Loughlin et al. 1984).

4.9.4. Foraging

Steller sea lions are opportunistic predators, feeding primarily on a wide variety of fishes (e.g., capelin, cod, herring, mackerel, pollock, rockfish, salmon, sand lance), bivalves, cephalopods (e.g., squid and octopus) and gastropods (Pitcher 1981, Merrick et al. 1997). On rare occasions, Steller sea lions prey on seals and possibly sea otter pups.

Their diet may vary seasonally depending on the abundance and distribution of prey. Womble et al. (2009) found that "a reasonable annual foraging strategy for Steller sea lions is to forage on herring aggregations

in winter, spawning aggregations of forage fish in spring, salmon in summer and autumn, and pollock and Pacific hake throughout the year.” They may disperse and range great distances to find aggregated prey but are not known to migrate. Steller sea lions can dive to approximately 400 m (1,300 ft) in depth to exploit deep prey resources.

4.9.5. *Acoustic 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 to 30 kHz; however, hearing of one individual was found to be most sensitive to noise from 5 to 14.1 kHz (Muslow and Reichmuth 2010). Underwater, best hearing range of a Steller sea lion has been measured at from 1 to 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 (Southall et al. 2007). Steller sea lions use both aerial and underwater vocalizations during breeding, territorial disputes, and rearing of pups (Kastelein et al. 2005a).

4.10. Harbor Seal (*Phoca vitulina*)

4.10.1. *Status*

The harbor seal is protected under the MMPA but is not listed as a strategic or depleted species under the MMPA (Muto et al. 2018). The harbor seal is not listed as threatened or endangered under the ESA.

The total Alaska-wide abundance estimate is 205,090 seals based on surveys taken between 1998 and 2011 (Muto et al. 2018). Within Alaska there are a total of 12 stocks of harbor seals ranging along the coastal waters from the eastern coast of the Aleutian Islands to Cape Muzon in Southeast Alaska (Muto et al. 2018). The Prince William Sound stock is the only one found in the Action Area waters. The current population estimate for this stock is 29,889 individuals and is slightly increasing based on a five-year trend (Muto et al. 2018).

4.10.2. *Distribution*

Harbor seals are found in coastal and estuarine waters ranging from Baja California to the eastern Aleutian Islands of Alaska. Harbor seals often inhabit nearshore coastal waters and are considered non-migratory, typically staying within 24 to 50 km (15 to 31 mi) of their home. Harbor seals typically stay within 25 km (16 mi) of shore but have been found up to 100 km (62 mi) offshore (Kinkhart et al. 2008). Harbor seal movement is highly variable, with no seasonal patterns identified.

Up to 44 percent of their time is spent hauled out, with hauling out occurring more often during the summer (Pitcher and Calkins 1979, Kinkhart et al. 2008). Harbor seals haul out in groups of 30 or less but have been known to rarely haul out in numbers of several hundred. There are no defined haulout locations for harbor seals as harbor seals will haul out where conditions are preferable to rest, give birth, and/or molt (Sease 1992).

Harbor seals use a variety of terrestrial sites to haul-out for resting (year-round), pupping (May-July), and molting (August-September) including tidal and intertidal reefs, beaches, sand bars, and glacial/sea ice

(Sease 1992, Kinkhart et al. 2008). Some sites have traditional/historic value for pupping and molting while others are used as temporary resting sites during seasonal foraging trips.

4.10.2.1. Presence, Abundance, and Seasonality in the Action Area

Harbor seals are an irregular presence in the Action Area. Small numbers have been reported (K. Sinclair, Whittier Harbormaster, pers. comm.) in the Whittier boat harbor feeding on the mussels and barnacles growing on the harbor pilings but apparently remained only if this food source remained. They are occasionally seen mid-inlet throughout the year and four to ten individuals have recently been observed hauled out on a rock pinnacle at the mouth of Logging Camp Bay approximately 12.4 km (7.7 mi) northeast of the Action Area (M. Bender, Lazy Otter Charters, pers. comm.). Harbor seals are the species most likely to be present in the Action Area during the proposed pile driving.

4.10.3. Reproduction and Breeding

In Alaska, harbor seals typically give birth to single pups between May and mid-July (Kinkhart et al. 2008). Pupping and weaning coincide with the summer haulout and the weaning process is completed by July (Sease 1992). The birthing location of harbor seal pups occurs at many different haul-out sites and is not restricted to a few major rookeries (Kinkhart et al. 2008).

4.10.4. Foraging

Harbor seals commonly eat walleye pollock, octopus (*Octopus* spp.), capelin, herring, and Pacific cod. Pups usually eat small fishes (Pitcher and Calkins 1979). Harbor seals were reported to feed extensively on the barnacles (*Sessilia*) and mussels (*Mytilus edulis*) growing on the pilings in Whittier Harbor (K. Sinclair, Whittier Harbormaster, pers. comm.).

4.10.5. Acoustic Ecology

The hearing range of harbor seals extends above 60 kHz (Jacobs and Terhune 2002) although their hearing is most acute below 60 kHz (Kastelein et al. 2009). Harbor seals are more sensitive to lower frequency sounds with the highest sensitivity occurring at 32 kHz in water and 12 kHz in air (Terhune and Turnball 1995, Kastak and Schusterman 1998, Wolski et al. 2003). Harbor seals are considered part of the Phocid Pinniped hearing group (Southall et al. 2007).

5. TYPE OF INCIDENTAL TAKE AUTHORIZATION REQUESTED

5.1. Take Authorization Request

DOT&PF requests an IHA for Level B harassment of marine mammals described in this application, authorized under Section 101(a)(5)(D) of the MMPA, during the Whittier Ferry Terminal modification project. No Level A takes are requested. DOT&PF requests an IHA for one year with an effective date of February 1, 2020. Once the IHA is received, DOT&PF will proceed with impact and vibratory pile driving per the terms agreed upon in the IHA, including implementation of mitigation measures. The requested authorization is for the incidental harassment of five species (of the ten species of marine mammals evaluated) that might enter the associated behavioral disturbance isopleth during project activities.

The noise levels and potential impact isopleths that are expected to result from the construction of this project are described in detail in the sections below. Mitigation measures (including operational shutdown and monitoring zones) will be incorporated into the project to minimize the potential for unauthorized injury or harassment. Protocols for observation and mitigation methods are discussed in detail in Section 11 and in Appendix A – Marine Mammal Monitoring and Mitigation Plan (4MP). Takes of non-permitted species (those unlikely to be present) will be prevented by the mitigation measures described in the 4MP, including shutting down of activities at the approach of a non-permitted marine mammal to the Level B zone.

5.2. Method of Incidental Taking

The Whittier Ferry Terminal modification project includes pile extraction and re-installation (pile driving) in an area where marine mammals have been observed. Planned pile driving activities will temporarily increase the underwater and airborne noise within the project area. This increase in noise has the potential to result in the behavioral disturbance (a form of take) of local marine mammals.

6. NUMBER OF MARINE MAMMALS THAT MAY BE AFFECTED

A request for IHA requires that the applicant apply appropriate regulatory thresholds and modeling of source sound transmission and animal density to estimate the number of marine mammals by species that might be affected by the construction project. These estimates become the basis for authorizing harassment take.

6.1. Regulatory Thresholds and Modeling for the Effects of Anthropogenic Sound

Unless otherwise noted, the following notations will be used to express thresholds:

- **Peak Sound Pressure Level (SPL_{PK}):** The maximum absolute value of the instantaneous sound pressure that occurs during a specified time interval, measured in dB re: 1 μPa (e.g., 198 dB_{PK}) (Buehler et al. 2015).
- **Average Root Mean Square Sound Pressure Level (SPL_{RMS}):** A decibel measure of the square root of mean square pressure. For pulses, the average of the squared pressures over the time that comprises that portion of the wave form containing 90 percent of the sound energy of the impulse in dB re: 1 μPa (for underwater) and dB re: 20 μPa (for airborne) is used (e.g., 198 dB_{PK}) (Buehler et al. 2015).
- **Sound Exposure Level (SEL):** The integral over time of the squared pressure of a transient waveform, in dB re: 1 μPa^2 -sec (e.g., 173 dB_{SEL}). This approximates sound energy in the pulse (Buehler et al. 2015).
- **Cumulative Sound Exposure Level (SEL_{CUM}):** Cumulative exposure over the duration of the activity within a 24-hour period referenced to 1 second (NMFS 2015).
- **Transmission Loss (TL):** The decrease in acoustical energy as an acoustical pressure wave propagates out from a source.

6.1.1. Cumulative Sound Threshold Guidance, PTS

Determination of the cumulative underwater sound exposure levels (SEL_{CUM}) required to cause permanent threshold shift (PTS) in marine mammals within the Action Area was based on the technical guidelines published by NMFS in August 2016 and revised in April 2018 (NMFS 2018f). This guidance considers the duration of the activity, the sound exposure level produced by the source during one working day, and the effective hearing range of the receiving species. Regulatory thresholds for potentially affected species, measured in one-day SEL_{CUM} , are summarized in Table 3.

Table 3. SEL_{CUM} PTS onset thresholds (NMFS 2018f).

Underwater - (dB re: 1 μ Pa ² s)					
Source	Low-Frequency (LF) Cetaceans	Mid-Frequency (MF) Cetaceans	High-Frequency (HF) Cetaceans	Phocid Pinnipeds (PW)	Otariid Pinnipeds (OW)
Non-impulsive Noise	199	198	173	201	219
Impulsive Noise	183	185	155	185	203

Calculation of impact isopleths under the new guidance utilized the methods presented in Appendix D of the *2018 Revision to Technical Guidance for Assessing the Effects of Anthropogenic Sound on Marine Mammal Hearing* and the most recent version of the associated User Spreadsheet Tool (NMFS 2018f). The spreadsheet accounts for effective hearing ranges using Weighting Factor Adjustments (WFAs), and this application uses the recommended values therein. Activity durations were estimated based on similar project experience.

6.1.2. Peak Sound Threshold Guidance, TTS and PTS

In addition to thresholds for cumulative noise exposure, onset thresholds for peak sound pressures must be considered for impulsive sources. Peak sound pressure level (SPL_{PK}) is defined as “the greatest absolute instantaneous sound pressure within a specified time interval and frequency band” (NMFS 2018f). The peak pressure thresholds for each hearing group is found in Table 4.

Table 4. SPL_{PK} thresholds for impulsive noise (NMFS 2018f).

Underwater - (dB re: 1 μ Pa)					
Source	Low-Frequency (LF) Cetaceans	Mid-Frequency (MF) Cetaceans	High-Frequency (HF) Cetaceans	Phocid Pinnipeds (PW)	Otariid Pinnipeds (OW)
TTS Onset	213	224	196	212	226
PTS Onset	219	230	202	218	232

6.1.3. Interim Sound Threshold Guidance, Behavioral Disturbance

The updated guidance described above does not address behavioral disturbance from underwater or airborne noise. The interim sound threshold guidance previously published by NMFS and summarized in Table 5 will be used for estimating exposure behavioral disturbance isopleths (NMFS 2015).

Airborne noise thresholds have not been established for cetaceans (NMFS 2015), and no adverse impacts are anticipated from airborne noise to cetaceans in the Action Area.

Table 5. Behavioral disturbance thresholds (NMFS 2015).

Underwater - (dB re: 1 µPa)		
Source	Cetaceans & Pinnipeds	
Non-impulsive Noise	120	
Impulsive Noise	160	
Airborne - (dB re: 20 µPa)		
Source	Harbor Seals	Other Pinnipeds
All Source Types	90	100

6.2. Sources of Anthropogenic Sound

In the Technical Guidance (NMFS 2018f), sound sources are divided as;

- Non-impulsive: produce sounds than can be broadband, narrowband or tonal, brief or prolonged (intermittent or continuous), and typically do not have a high peak sound pressure with rapid rise/decay time that impulsive sounds do.
- Impulsive: produce sounds that are typically transient, brief (less than 1 second), broadband, and consist of high peak sound pressure with rapid rise time and rapid decay.

The continuous underwater sound produced by vibratory hammer during pile removal and reinstallation is a form of non-impulsive sound, while the impact hammer used during final proofing of the piles during reinstallation produces impulsive sound.

6.3. Calculated Impact Isopleths

6.3.1. Level B Thresholds

The NMFS considers a Level B harassment to occur when a marine mammal is exposed to continuous underwater noise levels (such as vibratory hammering) exceed 120 dB SPL or impulsive noise levels (such as impact hammering) exceeding 160 dB SPL. The distances to the 120-dB and 160-dB isopleth thresholds (the radius around the project exceeding these underwater threshold values) can be determined by acoustically measuring noise levels within the vicinity of the project. These sound source verification (SSV) measurement are typically conducted in two ways: 1) a drift method whereby sound levels are measured from dipping a hydrophone deployed off a boat as the boat drifts away from the project, hopefully far enough away to cross and fix the exact radius of the isopleth and 2) a fixed-location method whereby one or more hydrophones are deployed at varied locations from the source and the threshold isopleth distance determined by interpolating or extrapolating from the hydrophone locations using regression analysis. Both methods may need to extrapolate for distances (e.g., longer-range 120-dB threshold distances for loud continuous sources) in the far-field.

Project specific information on threshold radii is typically not available at the time of authorization request. In that case, radii are estimated using proxy source and transmission loss (TL) values from past projects involving similar hammer sizes, pile sizes, or waterbodies. Previous SSVs typically include the source value determined by back-extrapolating from the nearest measurement to a reference point source either 10 meters

or 1 meter from the actual source, and a transmission loss coefficient, which is the rate of sound propagation from the source. An estimate of distance to the threshold isopleths can be calculated from these values.

Because SSV measurements have not been conducted at Whittier, proxy values are necessary for estimating threshold radii. The Whittier project will involve 30-inch steel piles placed in a water depth of 9 m (30 ft) using hammer sizes (and energy) typical for those size piles. Whittier is located near the head of Passage Canal, a narrow (2.5-km [1.6-mi]), deep-water (200-225 m [656-738 ft]) fjord. Sound levels are expected to both channel down the fjord but also dissipate (dilute) relatively quickly due to the deep water (inverse-square law). The “fall-off” rate in sound energy, known also as the TL, generally falls within a “cylindrical” regression rate (10 Log r) and a “spherical” rate (20 Log r) (r is the radius to be solved for). When site-specific TL values are not available for a project, NMFS (2018f) requests that a mid-rate (15 Log r), known as the “practical spreading model”, be used in the calculations.

In 2015, DOT&PF commissioned Denes et al. (2016) to measure underwater sound levels and empirically estimate distances to relevant sound level thresholds for marine mammal injury and harassment at four different pile driving (terminal improvement) projects (Table 6). The hydroacoustic study was specifically conducted to inform noise impact assessments and to guide monitoring and mitigation requirements for future DOT&PF dock and ferry terminal improvements. Because pile size (and associated hammer energy) has a direct bearing on sound source levels, the Denes et al. (2016) results are appropriate proxy values for the Whittier project given similar pile sizes (24-in or 30-in), as opposed to other projects considered that involved much larger (48-in) piles (e.g., Austin et al 2016, Illingworth & Rodkin 2019).

Besides pile size, the amount of pile within the water column due to water depth also influences the sound levels at source. This is because the more surface area of pile within the water column, the more surface radiating of sound into the water. Given that the water depths at Kake location (11.8 m) are the closest to the depth at Whittier (9 m), coupled with the identical pile sizes (30-in steel), Kake sound source values may be appropriate proxy values for estimating distances to threshold isopleths. However, NMFS considered that median sources value collected at Auke Bay were more appropriate based on similarities in substrate. The softer (muddier) sediments at Kake may have influenced the relatively low vibratory values from there, while Auke Bay can be considered conservative and, therefore, sufficiently protective of the marine mammal resources.

Table 6. Unattenuated sound source levels measured at five pile driving projects (Denes et al. 2016).

Location	Water Depth (m)	Pile Size	Surface Area within Water Column (m ²)	Sound Source ¹ (dB)	
				Vibratory	Impact
Kodiak	5.0	24-in steel	10.3	152.3	181.1
Kake	11.8	30-in steel	29.1	155.8	194.4
Ketchikan	13.9	30-in steel	34.1	161.9	195.0
Auke Bay	18.9	30-in steel	46.0	168.0	191.3

1. Median value measured at 10 m from source.

Applying a 15 TL coefficient to the Auke Bay source data for both vibratory and impact results in the radii to Level B threshold isopleths shown in Table 7. However, due to inlet topography, the maximum distance sound generated at the ferry terminal can travel within the inlet is 12.0 km (7.5 mi) (Figure 4). The vibratory pile driving ensonification area (the Action Area) is 20.5 km² (7.9 mi²) and represents 41.9 percent of the total area (48.9 km² [18.9 mi²]) of Passage Canal. The impact hammer ensonified area is much smaller at 1.24 km² (0.48 mi²).

Table 7. Radii to Level B threshold isopleths.

TL Coefficient	Vibratory Hammering		Impact Hammering	
	Source (dB)	120-dB Radius (km)	Source (dB)	160-dB Radius (km)
15	168.0	15.8	191.3	1.2

6.3.2. Level A Thresholds

Excessive underwater sound close to the noise source can result in a permanent threshold shift (PTS) in the hearing of exposed marine mammals. Exposures to noise levels where onset of PTS is thought to occur is considered by NMFS to be a Level A harassment take. These thresholds vary by hearing group (Table 8). Based on the proposed pile driving activity, the radii to thresholds vary from 20 m to 652 m (66 ft to 2,139 ft) for impact pile driving and 1 m to 32 m (3 ft to 105 ft) for vibratory pile driving (Table 8). The acoustical calculation spreadsheets can be found in Appendix B.

Table 8. Radii to Level A threshold isopleths (PTS onset).

Parameter	Hearing Group				
	Low-Frequency Cetaceans	Mid-Frequency Cetaceans	High-Frequency Cetaceans	Phocid Pinnipeds	Otariid Pinnipeds
Impact Pile Driving					
SEL_{cum} Threshold (dB)	183	185	155	185	203
Radii to PTS Onset (m)	547	20	652	293	21
Vibratory Pile Driving					
SEL_{cum} Threshold (dB)	199	198	173	201	219
Radii to PTS Onset (m)	22	2	32	13	1

The radii will be used to establish Level A safety zones whereby hammering will be shut down when a marine mammal approaches a safety zone appropriate for that species. For this project, the proposed safety zone radii for impact pile driving (proofing) are found in Table 9. These radii will be monitored by protected

species observers (PSOs) positioned near the pile driving activity and at the approach of a marine mammal to these zones, the PSO will radio an alert to the pile driving foreman who will immediately implement a shut-down of all pile hammering activities. The Level A radii to PTS thresholds for vibratory hammering ranged from 1 m to 32 m (3 ft to 105 ft) , with essentially all levels exceeding Level A threshold confined to within the docking berth. An inclusive 50-m (164-ft) shutdown safety zone will be monitored during all vibratory hammering activity (Figure 5). Impact pile driving Level A safety zone isopleths are shown in Figure 6.

Table 9. Proposed safety zone radii for impact pile driving.

Hearing Group	Representative Species	Impact Safety Zone Radii (m)
Low-Frequency Cetaceans	Humpback Whale	550
Mid-Frequency Cetaceans	Killer Whale	25
High-Frequency Cetaceans	Harbor Porpoise	700
Phocid Pinnipeds	Harbor Seal	300
Otariid Pinnipeds	Steller Sea Lion	25

6.3.3. Airborne Noise

Behavioral disturbance thresholds from exposure to pile driving airborne noise are established only for pinnipeds and are 90 dB re 20 μ Pa for harbor seals and 100 dB re 20 μ Pa for all other pinnipeds including Steller sea lions. There are no data specific to Alaskan projects, but airborne source levels and radii to thresholds have been measured in Washington (Laughlin 2010, Soderberg and Laughlin 2016). Laughlin (2010) measured airborne noise from a 30-inch test pile at the Keystone Ferry Terminal (Puget Sound) and found an overall average un-weighted level of 96.5 dB_{LEQ/RMS} standardized to 15 m (49 ft). Soderberg and Laughlin (2016) measured airborne sound levels from impact driving a 36-inch steel pile at Colman Dock (Puget Sound) and calculated an un-weighted level of 101 dB_{LEQ/RMS} standardized to 15 m (49 ft), and an A-weighted value of 97 dB_{A,LEQ/RMS}. The A-weighted measurements emphasize the frequency range (1 to 6.3 kHz) where human hearing is most effective and may not be suitable for amphibious pinnipeds adapted to both in-air and underwater hearing. Thus, only the unweighted values are used in calculating airborne isopleths. Based on the above source data, the distances to thresholds in all cases are but a few tens of meters (Table 10). The nearest location where harbor seals have been known to haulout is within the Whittier Public Boat Harbor over 225 m (738 ft) to the west (K. Sinclair, Whittier Harbormaster, pers. comm.) The harbor is not used regularly by harbor seals (see Section 4.10.2.1). The nearest known Steller sea lion haulout on a buoy within Shotgun Cove over 16 km (10 mi) from the project site (M. Bender, Lazy Otter Charters, pers. comm.). Further, all airborne radii are less than or equivalent to the PTS onset radii, which will demarcate the shutdown safety zones that will be implemented for this project. Thus, the airborne

noise components of the project will have no behavioral impact to pinnipeds that won't already be mitigated with the establishment of underwater safety zones.

Table 10. Calculated isopleths – airborne sources.

Source	Source Level	Behavioral Disturbance Isopleth (m)	
		Harbor Seals	Other Pinnipeds
Impact Installation	101 dB _{LEQ} at 15 meters ¹	53	17
Vibratory Installation	96.5 dB _{LEQ} at 15 meters ²	32	10

1. Soderberg and Laughlin (2016).

2. Laughlin (2010).

6.4. Take Estimation and Request

6.4.1. Level B Take Estimation and Request

The standard method for estimating harassment take is to multiply the area ensonified by the animal density and then by the number of days of activity. However, no animal density data is available as Passage Canal has not been systematically surveyed for marine mammals and marine mammal use is sporadic in the inlet at best. The most reliable information on local marine mammal populations comes from the whale watching charters based out of Whittier, which have operated for over 20 years in Passage Canal with the specific intent of searching for marine mammals to show their customers, including during the early spring work-window for this project. Based on local knowledge and seasonality, it is highly unlikely that fin whales, minke whales, gray whales, Pacific white-sided dolphins, or harbor porpoises would be present in the Action Area during the proposed pile driving activity. In the unlikely event these animals do appear, unauthorized take will be avoided by shutting down activities at the approach of one or more of these animals to the Level B monitoring zone.

Take authorization is requested for the remaining five species based on the rationale below. Requested take as a percentage of stock is found in Table 11.

Table 11. Requested number of authorized takes.

Species	Level B Take Requested	Estimated Abundance ¹ (Stock)	Requested Level B Take as a Percentage of Stock
Humpback Whale	6	10,103 (Central North Pacific)	0.06
		1,918 (California/Washington/Oregon)	0.31
		1,107 (Western North Pacific)	0.54
Killer Whale	20	2,347 (Eastern North Pacific, Alaska Resident)	0.85

Species	Level B Take Requested	Estimated Abundance ¹ (Stock)	Requested Level B Take as a Percentage of Stock
		587 (Gulf, Aleutian, Bering Transient)	3.41
		7 (AT1 Transient)	285.71
Dall's Porpoise	5	83,400 (Alaska)	0.01
Steller Sea Lion	15	53,303 (Western U.S.)	0.03
Harbor Seal	15	29,889 (Prince William Sound)	0.05

1. Abundance estimates are from the most recent published stock reports (Carretta et al. 2018, Muto et al. 2018).

6.4.1.1. Humpback Whale

Due to seasonal patterns and the very few historical observations of humpback whales inhabiting Passage Canal, it is anticipated that the likelihood of a whale present in the Action Area during pile driving activities is extremely remote. However, year-round use of Prince William Sound by humpback whales appears to be increasing (Straley et al. 2018) and, given the geography of Passage Canal in which a whale could be confined within the Action Area for extended periods resulting in prolonged project delay, DOT&PF is requesting a small number of takes of humpback whales. Assuming the possibility of a single whale entering Passage Canal and remaining for several days (if herring are present), the take request is one whale for each of the six days of pile driving, or **six (6) humpback whales** total.

6.4.1.2. Killer Whale

Killer whales are year-round residents of Prince William Sound and have been observed making sorties into Passage Canal on a very irregular basis. It is possible that a pod of killer whales might venture into the Action Area during days of active pile driving. It is assumed that due to a lack for fish (resident whales) or marine mammal (transient whales) prey in the inlet, killer whale presence would be brief. Multiple pods regularly or occasionally inhabit Prince William Sound with two pods (AB and AE pod) occasionally venturing into the northern waters of the Sound (Scheel et al. 2001). The largest of these pods (AB) is comprised of 20 individuals (as of 2012). Given the impact a non-permitted pod of killer whales could have on pile driving operations, DOT&PF is requesting take authorization for **twenty (20) killer whales** equating to a single pod (AB) visiting the Action Area for a day.

6.4.1.3. Dall's Porpoise

Dall's porpoises have frequently been observed near the entrance to Passage Canal, including in the spring, although local whale charters do not recall seeing them as far into the inlet as the Action Area. Surveys by Hall (1979) and Moran et al. (2018) indicate that these porpoises are year-round residents within Prince William Sound, but with spring use concentrated in the western side of the Sound. Still, Moran et al. (2018) developed a predictive model of encounter rates based on past sightings and habitat features, which indicated a low potential presence in Passage Canal. The same study also indicated that the spring use of bays within the Sound has increased since the 1970s, perhaps due to reduced predation pressure from killer whales. Collectively, this information indicates that the likelihood Dall's porpoise occurrence in the Action

Area during the project is low, but not discountable. Thus, DOT&PF is requesting take authorization for **five (5) Dall's porpoises** based on the springtime average size (4.59) of a single group from Prince William Sound surveys conducted by Moran et al. (2018).

6.4.1.4. Steller Sea Lion

Steller sea lions are irregular visitors to the Action Area and most commonly found near the Whittier Ferry Terminal during the summer salmon runs (M. Bender, Lazy Otter Charters, pers. comm.). Occurrence in the Action Area during the spring is less likely due to a lack of prey present. However, sea lions haul out year-round on a buoy located within Shotgun Cove located approximately 6 km (3.7 mi) from the Action Area and certainly could be present in the Action Area during planned activities. The size of the buoy limits the number of sea lions that can use it as a haulout to about ten animals, although five is more likely on any given day. Based on that number, we assume that half those animals on any given day of pile driving activity could enter Action Area and remain there for several hours. Thus, DOT&PF is requesting a take authorization of **fifteen (15) Steller sea lions** based on an average of 2.5 sea lions occurring within the Action Area over the six days of pile driving activity.

6.4.1.5. Harbor Seal

Harbor seal use of the Action Area is occasional and sporadic. If food is available, small numbers of harbor seals may remain for extended periods in the Whittier boat harbors feeding on sessile invertebrates growing on harbor pilings. Otherwise, they are only occasionally seen in the mid-inlet, although sightings do occur year-round. Recently, four to ten seals (generally about five) have been observed hauling out on a rock pinnacle in Logging Camp Bay located 12.4 km (7.7 mi) east of the Action Area (M. Bender, Lazy Otter Charters, pers. comm.). If the Action Area falls within the foraging range of these seals, we assume that on any given day, half (2.5 average) of these seals might occur in the Action Area during each of the six days of pile driving. Thus, DOT&PF is requesting take authorization for **fifteen (15) harbor seals**.

6.4.2. Level A Take

DOT&PF is not requesting Level A take for any of the marine mammal species that could be encountered in the Action Area. DOT&PF will monitor safety zones (Table 9) and implement shut down of pile driving activity as needed to avoid Level A take.

6.4.3. Requested Take as a Percentage of Stock

In all cases the requested take as a percentage of the stock is less than 1 percent except for the two stocks of transient killer whales. The percentage of the Gulf of Alaska, Aleutian Islands, and Bering Sea transient stock remains at 3.41 percent a “small number” of takes, and these whales are rarely seen penetrating the center of the Sound preferring inside outside passages such as Montague Strait. However, the nearly extinct AT1 transient stock includes only seven individuals as of 2015, resulting in the requested take of 20 killer whales (based on a single resident pod) being a large 285.71 percent of that stock. Between 1984 and 2003, Matkin et al. (2012) encountered this stock 203 times within Prince William Sound and Kenai Fjords with Wells Passage the closest location (25 km [15.5 mi]) to the Action Area (although most sightings have occurred within Knight Island Passage 60 to 100 km (37 to 62 mi) south of the Action Area.

6.4.4. *ESA-listed Species*

DOT&PF is requesting Level B take authorization for two ESA-listed species: humpback whale and Steller sea lion (no Level A take authorization is requested). The take request is for six humpback whales with a mathematical likelihood that one of these whales would be a member of a listed DPS, based on Wade et al.'s (2016) assertion that 11 percent of the humpback whales found in the Gulf of Alaska, including Prince William Sound, would be part of either the threatened Mexico DPS (10.5%) or endangered Western North Pacific DPS (0.5%).

DOT&PF is also requesting Level B take authorization for fifteen (15) Steller sea lions. All sea lions in the Action Area are expected to be members of the endangered Western U.S. DPS.

7. ANTICIPATED IMPACT ON SPECIES OR STOCK

The proposed project has the potential to impact the marine mammals described above (primarily Steller sea lions, harbor seals, and humpback whales) by increasing noise in Passage Canal. The project also has the potential to temporarily increase the low likelihood of vessel interactions with marine mammals.

7.1. Noise

Pinnipeds and cetaceans are sensitive to underwater and airborne noise. Recent studies have shown that even moderate levels of underwater noise can cause a temporary loss in hearing sensitivity in some marine mammals. Increases in noise levels from in-water activities can reduce a marine mammal's capability to hear other noises, like background noise and noise created by their prey and predators, otherwise known as auditory masking (Southall et al. 2007). This results in difficulties with communication, predator avoidance, and prey capture, among others. Anthropogenic sounds can also result in behavioral modification, including changes in foraging and habitat use or separation of mother and infant pairs (Marine Mammal Commission 2007).

Marine mammals can also experience changes in sensitivity to sounds after exposure to intense sounds for long periods. These changes, called threshold shifts, can occur on a temporary or permanent level, depending on the intensity of the sound and length of time to which the animal is exposed to the sound. Typically, a temporary threshold shift (TTS) includes impacts to middle-ear muscular activity, increased blood flow, and general auditory fatigue (Southall et al. 2007). At the TTS level, the animals do not experience a permanent change in hearing sensitivity and exhibit no signs of physical injury. PTS would occur if the animal subjected to the increased sound level did not return to pre-exposure conditions within an order of weeks or if the animal exhibited physical injuries (Southall et al. 2007).

The proposed project will have the possibility of resulting in both Level A and Level B harassment of pinnipeds and cetaceans. Level A take will be avoided to the extent possible by shutting down noise-producing activities in at the approach of a marine mammal to the Level A shutdown zone. Level B harassment is temporary in nature, and the impacts associated with the potential harassment resulting from this project will be temporary, especially given that the maximum hammering time is only seven hours spread over six days.

7.2. Vessel Interactions

Passage Canal is mainly used for recreation and marine transportation, especially for the state ferry system and container shipments. The proposed dolphin modification will facilitate a larger ferry, that will replace the existing ferry. Therefore, this project is not likely to contribute to an increase in vessel traffic, but rather a small increase in vessel size. Nor is the project likely to result in a permanent increase in vessel traffic during the spring months. During construction, an increase in the likelihood of vessel interactions (barge movement and PSO vessels) may occur but will be limited to the duration of dolphin installation.

8. ANTICIPATED IMPACT ON SUBSISTENCE

Hunters from two native villages – Chenega Bay and Tatitlek – and native hunters living in Cordova annually harvest marine mammals within Prince William Sound as part of a subsistence lifestyle (Fall and Zimpelman 2016). Chenega Bay hunters annually harvest a few harbor seals and sea otters and have hunted Steller sea lions in the past (Wolfe et al. 2009). Most hunting occurs locally. Hunters from Tatitlek harvest harbor seals and sea lions over most of central Prince William Sound, although their hunting range does not extend to Passage Canal (Fall and Zimpelman 2016). Native hunters living in Cordova mostly harvest harbor seals but occasionally take sea otters and sea lions (Fall and Zimpelman 2016). All villages are greater than 100 km (62 mi) by boat travel from Passage Canal. Construction activities associated with the Whittier Ferry Terminal modifications project will have no impact on the ability of hunters from these villages to harvest marine mammals.

9. ANTICIPATED IMPACT ON HABITAT

9.1. Effects of Project Activities on Marine Mammal Habitat

The Whittier Ferry Terminal modification project involves moving the four piles comprising dolphin S3 1.2 m (4 feet), thus all habitat modification would remain within the same footprint as the existing ferry terminal and facilities. The total seafloor area affected from extracting and relocating piles is about 15 m² (161 ft²), a miniscule amount of area compared to the vast foraging area available to marine mammals in Prince William Sound. The pile driving process may likely result in removing barnacles and mussels (potential harbor seal prey) from the pilings, but once reseeded, these pilings would again be available as substrate for these sessile invertebrates.

9.2. Effects of Project Activities on Marine Mammal Prey Habitat

Pile driving in general can alter the behavior and distribution of local fish populations while loud impulsive hammering (impact pile driving) is capable of injuring or even killing of fish (Popper and Hastings 2009). Exposure of long periods of low levels of sound or short periods of higher levels can lead to TTS in fish (Buehler et al. 2015). Popper et al. (2005) found that fish exposure to substantial TTS generally recovered in less than 18 hours after exposure. PTS can also occur in fish but is more likely to occur during extreme levels of sound or very long exposure, levels and time periods generally not associated with pile driving.

Extreme sound levels can damage fish anatomy, including rupturing swim bladders or hemorrhaging of eyes and skin (Hastings and Popper 2005), although organ damage is usually not associated with the low frequency sounds associated with pile driving (Buehler et al. 2015). Still, the potential effects of pile driving on fish has not been fully explored, including long-term effects (Buehler et al. 2015).

However, fish species that are important as marine mammal prey, such as Pacific herring and salmon, will probably not be present in appreciable numbers during the February-March work-window. Therefore, it is unlikely that the planned pile driving will have a significant acoustical effect on the habitat of fish important to marine mammals.

10.ANTICIPATED IMPACT OF LOSS OR MODIFICATION OF HABITAT

No net loss of marine mammal habitat is expected to occur from the proposed pile driving at the Whittier Ferry Terminal. The project involves extracting four, 30-inch piles and then reinstalling them approximately 1.2 m (4 ft) farther east. The few square meters of water column and seafloor habitat lost due to the presence of four pilings at the new location will be offset by the removal of these pilings from the current location. Habitat avoidance due to elevated noise levels would be temporary and intermittent.

11. MITIGATION MEASURES

The following mitigation measures will be implemented during permitted activities to ensure the least practicable adverse impact, to minimize the effects of authorized impacts, and to record unavoidable, observable effects.

11.1. Construction Activities

The proposed project avoids impacts as much as practicable, but impacts cannot be avoided entirely as this project is dependent on, and being constructed for, maritime access. The applicant will incorporate the following measures and BMPs to minimize potential impacts:

- Pile extraction and re-installation will be performed in a manner that does not introduce any pollutants or debris into the water.
- Fuels, lubricants, chemicals and other hazardous substances will be properly stored to prevent spills. All refueling will be conducted at least 30 m (100 ft) away from the water, unless otherwise approved in the project's Hazardous Material Control Plan (HMCP).
- Oil booms will be readily available for containment should any releases occur.
- Standard spill-prevention measures will be implemented during construction to prevent spills or leakage of hazardous material. The contractor will always provide and maintain a spill clean-up kit on-site.
- The contractor will regularly monitor equipment and gear storage areas for drips or leaks, including inspection of fuel hoses, oil drums, oil or fuel transfer valves and fittings, and fuel storage that occurs at the project site. Equipment will be maintained and stored properly to prevent spills and mobilization of fuels, lubricants, chemicals, and other hazardous substances.
- If contaminated or hazardous materials are encountered during construction, all work near the contaminated site will be stopped until a corrective action plan is devised and implemented to minimize impacts on surface waters and organisms in the Action Area.

11.2. Soft Start Procedures

Soft start procedures shall be used prior to pile installation (impact hammer only) to allow marine mammals to leave the area prior to exposure to maximum noise levels. For other heavy equipment operating from barges, the equipment will be idled for 15 minutes prior to operation. If work ceases for more than 30 minutes, soft start procedures must recommence prior to performing additional work.

11.3. Monitoring of Harassment and Safety Zones

Qualified observers with stop-work authority will be on site before and during any in-water construction. Observers will monitor permitted activities in accordance with protocols reviewed and approved by NMFS. To monitor the shutdown and monitoring zones effectively, observers will be positioned at the best practicable vantage points taking into consideration security, safety, access, and space limitations.

Observers will be stationed at locations that provide adequate visual coverage for shutdown and monitoring zones (see Section 13). A detailed 4MP is provided in Appendix A.

All permitted pinnipeds and cetaceans that come within monitoring zones for pile driving activities will be recorded as potential exposures. If a marine mammal is observed approaching a shutdown zone, permitted activities will cease.

11.4. In-Water Construction Activities

To prevent acoustical injury to marine mammals from noise sources exceeding Level A thresholds, a 50-m (164-ft) radius shutdown safety zone will be monitored and shutdowns initiated as necessary during vibratory pile driving while for impact pile driving various shutdown radii (based on hearing group) will be monitored as shown in Table 9. PSOs will also monitor the Level B zones with a radius of 2.1 km (1.3 mi) for impact pile driving and 3.4 km (2.1 mi) for vibratory driving, which will provide an alert system to marine mammals approaching the Level A zone.

11.5. Vessel Interactions

To minimize impacts from vessel interactions with marine mammals, the crew aboard project vessels (tugs, barges, and monitoring vessels) will follow NMFS's marine mammal viewing guidelines and regulations as practicable, (<https://alaskafisheries.noaa.gov/protectedresources/mmv/guide.htm>), including not approaching any marine mammals by the marine mammal monitoring vessels.

12.ARTIC SUBSISTENCE USES, PLAN OF COOPERATION

This section is not applicable to the proposed project. Although the project will take place in Passage Canal, waters that are above the 60° North latitude demarcation for evaluating Arctic subsistence uses, no activities will take place in or near traditional Arctic subsistence hunting areas. Although the present location of Whittier was part of a portage route for the Chugach people native to Prince William Sound, there is no historical or archaeological evidence of native Alaskan settlement at the location of present-day Whittier (USACE 2015).

13. MONITORING AND REPORTING PLANS

13.1. Monitoring Plans

Measures to monitor potential impacts the project could have on marine mammals are discussed at length in the 4MP (Appendix A) and summarized below.

13.2. Acoustical Monitoring Plan

Given the information currently available on pile driving noise sources and propagation in similar Alaskan waters (e.g., Austin et al. 2016, Denes et al. 2016, Illingworth & Rodkin 2019), the low densities of marine mammals inhabiting Passage Canal, and short period of pile driving it will take to extract and reinstall four piles, DOT&PF is not proposing conducting acoustical monitoring at the Whittier Ferry Terminal.

13.3. Marine Mammal Monitoring and Mitigation Plan

13.3.1. Observer Qualifications

Monitoring will be conducted by qualified, trained observers. Observers will be independent (i.e. not construction personnel) and at least one observer will have prior experience working as a marine mammal observer during construction activities. Specific requirements to be considered qualified are detailed in Appendix A (4MP).

13.3.2. Data Collection

Observers will use a NMFS-approved Observation Record (Appendix A, 4MP) which will be completed by each observer for each survey day and location. The form will include columns for recording date and time, weather parameters, species and numbers, construction activities, marine mammal behaviors, reactions, observer and marine mammal location, and mitigation measures implemented. Additional detail is found in the 4MP (Appendix A).

13.3.3. Equipment

Standard equipment during monitoring will include Personal Protective Equipment, radios, cellular phones, contact information, tide tables, binoculars, GPS units, copies of the IHA and 4MP, and a notebook. Equipment detail is found in the 4MP (Appendix A).

13.3.4. Shutdown and Monitoring Zones

DOT&PF has established shutdown and monitoring zones to delineate areas in which marine mammals may be exposed to injurious underwater sound levels due to in-water construction. Work which could cause noise levels to rise above non-permitted thresholds will shut down if marine mammals are approaching shutdown zones. Observers will also monitor and document activities in areas where animals could be subjected to noise levels at or above the permitted thresholds.

Determination of shutdown and monitoring zones and the radii to thresholds are fully discussed in Section 6. A shutdown zone will be implemented during all over-water construction activities that have the potential

to affect marine mammals, and species/activity specific monitoring zones will be monitored to ensure that animals are not endangered by physical interaction with construction equipment. Take, in the form of Level B harassment, of marine mammals other than permitted species is not authorized and will be avoided by shutting down construction activities before individuals of these species enter the Level B harassment zone.

13.3.5. Observer Monitoring Locations

To monitor the shutdown and monitoring zones effectively, observers will be positioned at the best practicable vantage points taking into consideration security, safety, access, and space limitations. Observers will be stationed at locations that provide adequate visual coverage for shutdown and monitoring zones. During all types of installation observers will be stationed at the end of the terminal catwalk, and at strategic locations spaced along Shotgun Cove Road and Trail and spaced approximately 2.5 km (1.5 mi) apart (see the 4MP in Appendix A for a map of proposed locations). The road and trail are generally accessible by snowmobile during the February and March. Alternatively, if the trail is not accessible to the farthest reaches necessary to monitor the full Level B harassment zone, one or more vessel will be used as monitoring stations.

13.3.6. Monitoring Techniques

Observers will collect sighting data and behaviors of marine mammal species that are observed in the shutdown and monitoring zones during construction. All observers will be qualified and trained in marine mammal identification and behaviors. Shutdown and monitoring zones will be monitored 30 minutes prior to pile driving startup, during all activity, during delays of less than one hour. Activity will not start if the shutdown and monitoring zones are not fully visible due to weather or darkness, and for 30 minutes after activity ceases. The monitoring zone will serve as a shutdown zone for unauthorized species are present or the authorized take has been exceeded. Soft start procedures will be implemented prior to startup and after delays exceeding 30 minutes. Specific monitoring detail is found in the 4MP (Appendix A).

13.3.7. Reporting

The procedures for reporting are listed below and in the 4MP (Appendix A).

13.3.7.1. Initial Notification

DOT&PF will notify NMFS of that project startup is eminent one week prior to the actual start date.

13.3.7.2. Monthly Report

Recognizing that all marine mammal monitoring could be complete within a calendar month, DOT&PF will provide NMFS with a report at the end of each month of activity that includes 1) the number of animal sightings recorded during that month, 2) the number of sightings that occurred within the Level B zone (exposed), 3) the number of sightings that occurred within the Level A zone, 4) the number within the Level A zone that were exposed, and 5) the number of shutdowns that were implemented to avoid Level A take.

13.3.7.3. Annual Report

A comprehensive annual marine mammal monitoring report documenting marine mammal observations will be submitted to NMFS at the end of the in-water work season. The draft report will be submitted to

NMFS within 90 calendar days of the end of the in-water work period. The report will include marine mammal observations (pre-activity, during-activity, and post-activity) during in-water work. A final comprehensive report will be prepared and submitted to NMFS within 30 calendar days following resolution of comments on the draft report from NMFS.

The reports shall include at a minimum:

- General data:
 - Date and time of activity
 - Water conditions (e.g., sea-state)
 - Weather conditions (e.g., percent cover, percent glare, visibility)
- Specific pile driving data:
 - The construction contractor and/or marine mammal monitoring staff will coordinate to ensure that pile driving/drilling times (including strike counts) are accurately recorded. The duration of soft start procedures should be noted as separate from the full power duration; and
 - Description of in-water construction activity not involving pile driving/drilling (location, type of activity, onset and completion times).
- Pre-activity monitoring data:
 - Date and time permitted activity is initiated and terminated;
 - Description of any observable marine mammals and their behavior in the immediate area during monitoring; and
 - Times when in-water construction is delayed due to presence of marine mammals within shutdown zones.
- During-activity monitoring data:
 - Description of any observable marine mammal behavior within monitoring zones or in the immediate area surrounding the monitoring zones, including the following:
 - Distance from animal to pile driving/drilling sound source;
 - Reason why/why not shutdown implemented;
 - If a shutdown was implemented, behavioral reactions noted and if they occurred before or after implementation of the shutdown;
 - If a shutdown was implemented, the distance from animal to sound source at the time of the shutdown;
 - Behavioral reactions noted during soft starts and if they occurred before or after implementation of the soft start;
 - Distance to the animal from the sound source during soft start; and
 - Description of pile activities completed.
- Post-activity monitoring data:
 - Results, which include the detections and behavioral reactions of marine mammals, the species and numbers observed, sighting rates and distances; and
 - Refined exposure estimate based on the number of marine mammals observed. This may be reported as a rate of take (number of marine mammals per hour or per day) or using some other appropriate metric.

14.COORDINATING RESEARCH TO REDUCE AND EVALUATE INCIDENTAL TAKE

The data recorded during marine mammal monitoring for the proposed project will be provided to NMFS in monitoring reports. These reports will provide information on the usage of the site by marine mammals during the project activity period, but also an overview of use based on previous interviews with knowledgeable residents, especially the charter operators. The monitoring data and interview information will inform NMFS and future permit applicants about the presence and behavior of local pinnipeds and cetaceans for future projects of a similar nature.

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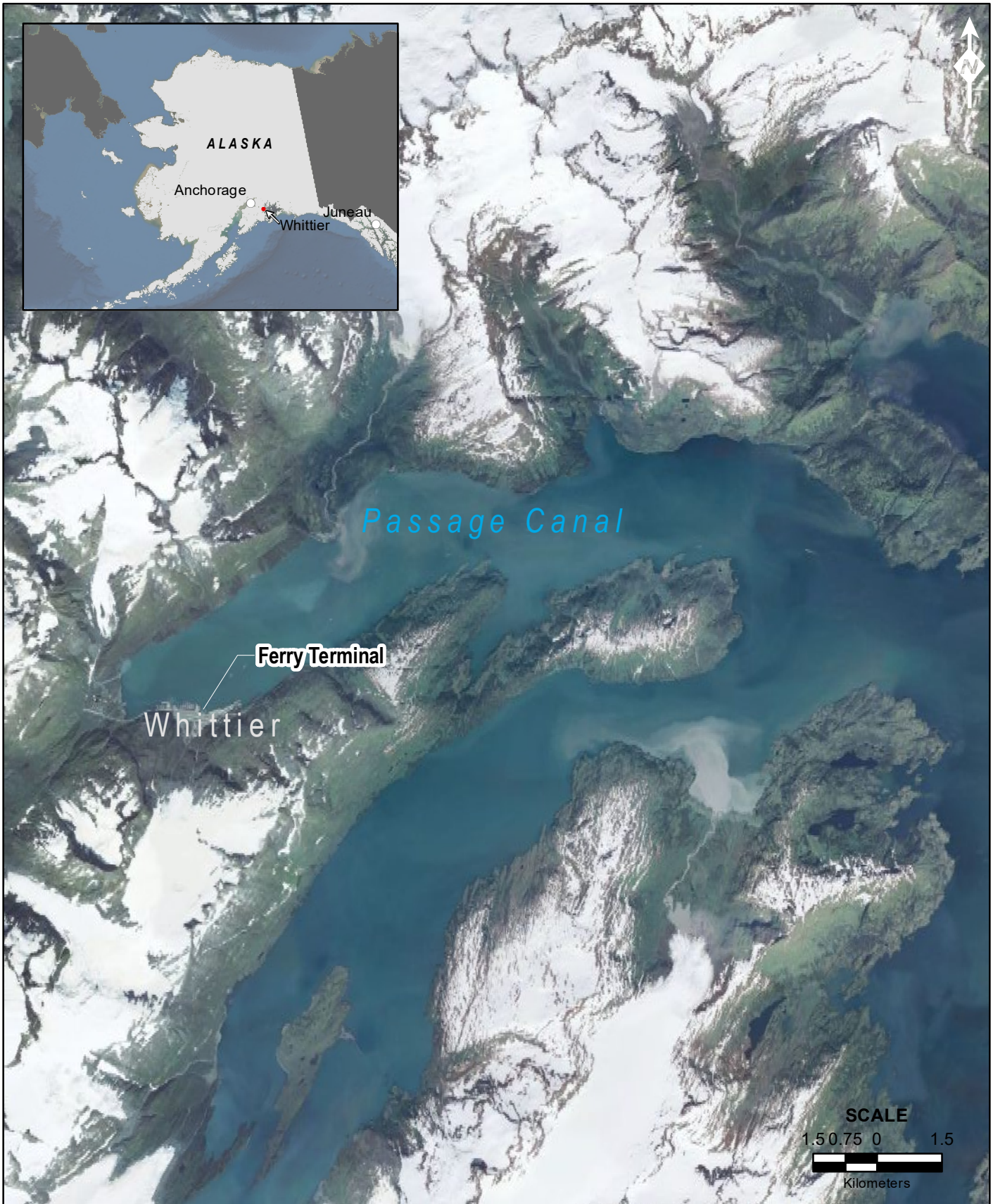
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FIGURES

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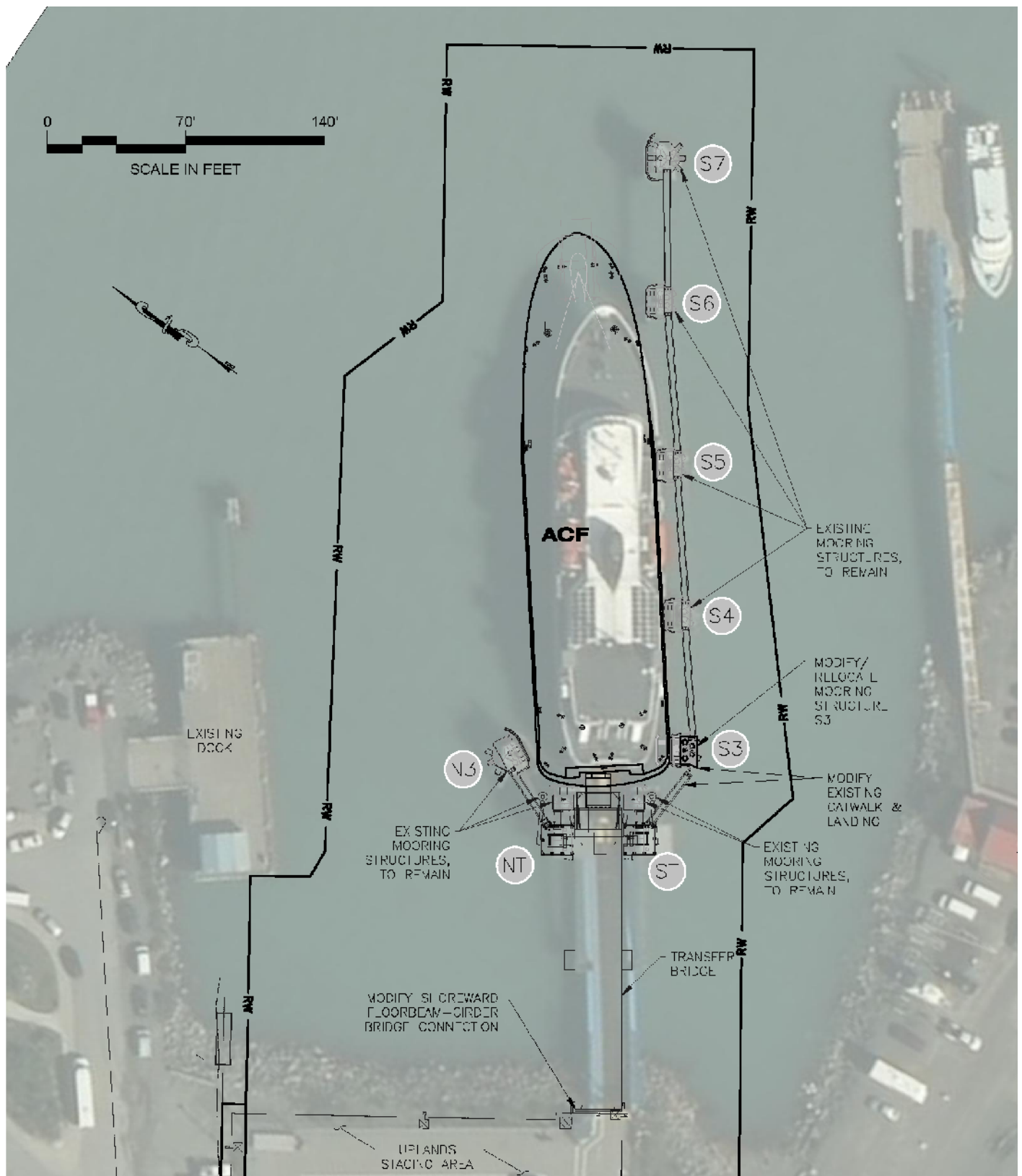


FERRY TERMINAL LOCATION

Whittier Ferry Terminal ACF Modifications
Alaska Department of Transportation
& Public Facilities

DATE: 7/23/2019

FIGURE: 1

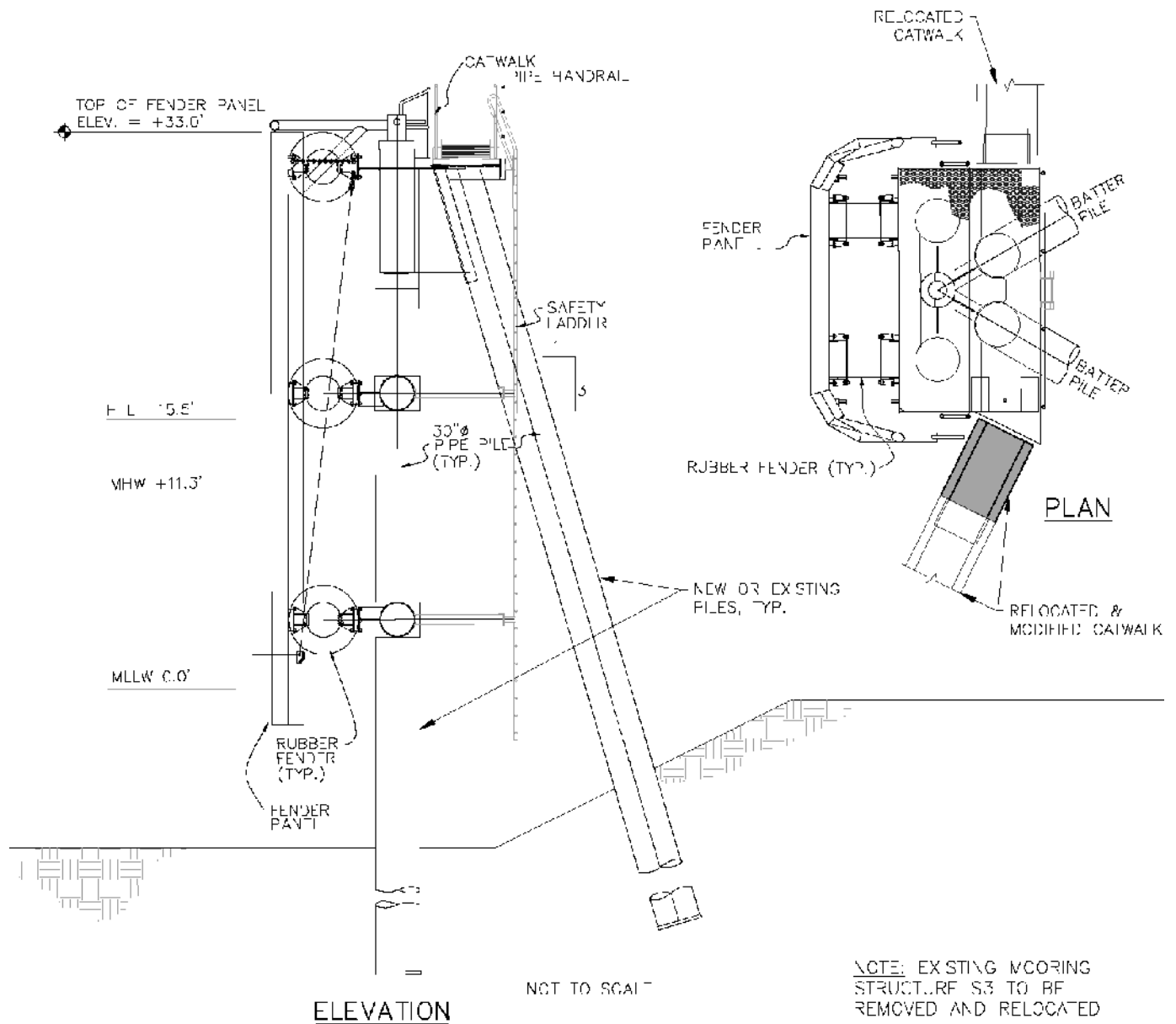


SITE PLAN

Whittier Ferry Terminal ACF Modifications
Alaska Department of Transportation
& Public Facilities

DATE: 06/04/2019

FIGURE: 2

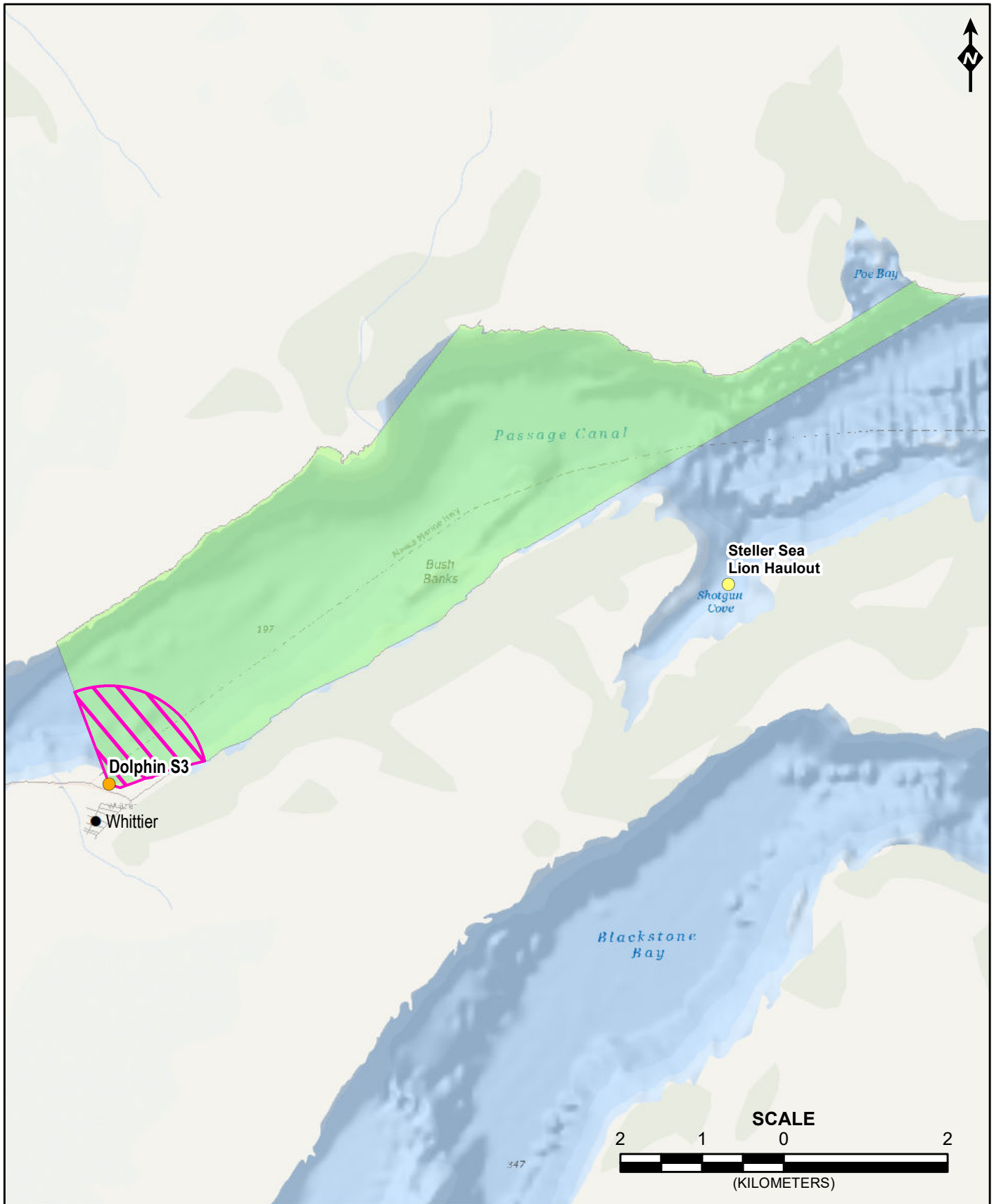


4-PILE DOLPHIN

Whittier Ferry Terminal ACF Modifications
Alaska Department of Transportation
& Public Facilities

DATE: **06/04/2019**

FIGURE: **3**



- Steller Sea Lion Haulout
- Sound Source at Dolphin S3

Ensonification Distance

- ▨ 1.2 km - Impact Monitoring Zone
- 12.0 km - Vibratory Monitoring Zone (Maximum Ensonification Area)

IMPACT AND VIBRATORY PILE DRIVING LEVEL B ENSONIFIED AREA

Whittier Ferry Terminal ACF Modifications
Alaska Department of Transportation
& Public Facilities

DATE: **08/26/2019**

FIGURE: **4**

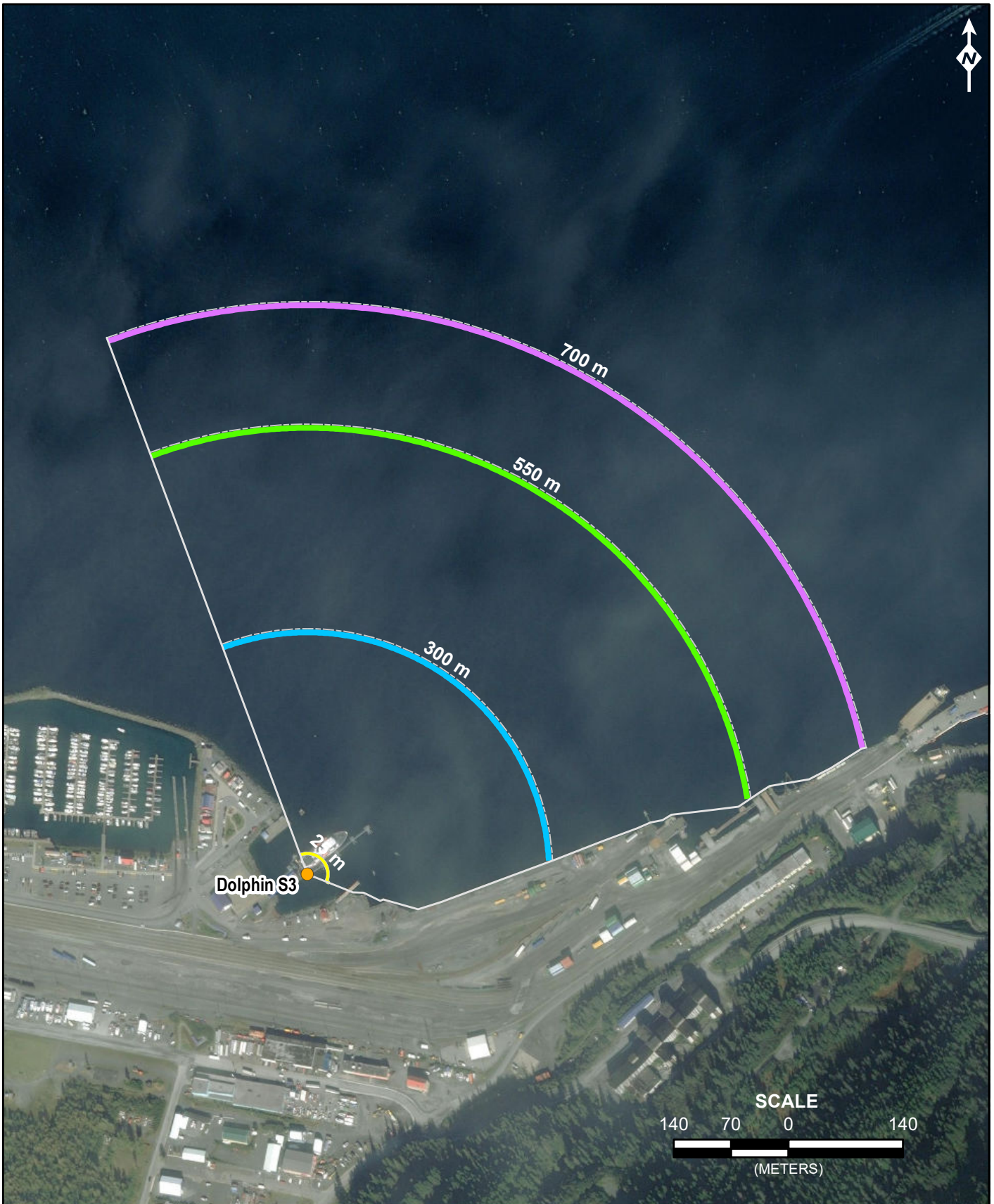






- Sound Source at Dolphin S3
- - - Level A Safety Zone - 50 m

**VIBRATORY PILE DRIVING
LEVEL A SAFETY ZONE ISOPLETH**
Whittier Ferry Terminal ACF Modifications
Alaska Department of Transportation
& Public Facilities

DATE: **07/23/2019**

FIGURE: **5**



<p>● Sound Source at Dolphin S3</p> <p>Hearing Group</p> <p>  Mid Frequency Cetaceans (Killer Whale) & Otariid Pinnipeds (Stellar Sea Lion) - 25 m  Phocid Pinnipeds (Harbor Seal) – 300 m  Low-Frequency Cetaceans (Humpback Whale) – 550 m  High-Frequency Cetaceans (Harbor Porpoise) – 700 m </p>	<p>LEVEL A SHUTDOWN SAFETY ZONES DURING IMPACT PILE DRIVING</p> <p>Whittier Ferry Terminal ACF Modifications Alaska Department of Transportation & Public Facilities</p> <tr> <td>DATE: 08/26/2019</td><td>FIGURE: 6</td></tr>	DATE: 08/26/2019	FIGURE: 6
DATE: 08/26/2019	FIGURE: 6		

APPENDIX A

Marine Mammal Monitoring and Mitigation Plan

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MARINE MAMMAL MONITORING & MITIGATION PLAN (FINAL)

Whittier Ferry Terminal ACF Modification

State Project No.:SAMHS00228

August 2019

Prepared for:

Alaska Department of Transportation & Public Facilities
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Figure 4. Level A shutdown safety zones during vibratory pile driving.

Figure 5. PSO Station 1 (catwalk) location.

Figure 6. PSO Station 1 (catwalk).

Figure 7. Impact and vibratory pile driving Level B ensonified area isopleths.

Figure 8. View of Passage Canal from PSO Station 2.

Appendices

A: Marine Mammal Observations

ACRONYMS AND ABBREVIATIONS

4MP	Marine Mammal Monitoring and Mitigation Plan
ACF	Alaska Class Ferry
AMHS	Alaska Marine Highway System
DOT&PF	Alaska Department of Transportation & Public Facilities
ESA	Endangered Species Act
GPS	global positioning system
IHA	Incidental Harassment Authorization
km	kilometer
mi	miles
MMPA	Marine Mammal Protection Act
NMFS	National Marine Fisheries Service
PSO	Protected Species Observer

1. INTRODUCTION

The Alaska Department of Transportation & Public Facilities (DOT&PF) is proposing improvements to the Whittier Ferry Terminal in Whittier, Alaska (Figure 1) to accommodate the new Alaska Class Ferry (ACF). The ACF is a stern/bow roll on-roll off design with more efficient loading and unloading capabilities and greater capacity. Several ferry terminals along the Alaska Marine Highway System (AMHS), including the Whittier Ferry Terminal, need to be modified to accommodate the roll on-roll off design and to provide safe and efficient berthing. At the Whittier terminal, three actions are required:

1. Relocate mooring structure S3.
2. Modify existing catwalk and landing.
3. Modify shoreward floor beam – girder bridge connection.

Relocation of the S3 mooring structure will require use of both impact and vibratory pile driving hammers, which produce underwater noise in excess of harassment “take” thresholds established by the National Marine Fisheries Service (NMFS). This requires take authorization under the Marine Mammal Protection Act (MMPA), and marine mammal monitoring during construction operations to quantify authorized take and avoid unauthorized take.

The purpose of this Marine Mammal Monitoring and Mitigation Plan (4MP) is to provide a protocol for monitoring affected species during construction. This 4MP was developed to support the Incidental Harassment Authorization (IHA) application under the MMPA, Section 101(a)(5)(D) permitting. The IHA application provides a detailed discussion on determining monitoring and safety zones for the proposed action.

A marine mammal monitoring program will be implemented at the start of specified construction activities and will follow the protocols outlined in this 4MP. The primary goals of the monitoring program are to:

1. Monitor the proposed monitoring and safety zones to estimate the number of marine mammals exposed to noise at or exceeding established thresholds, and to document animal responses.
2. Minimize impacts to marine mammal species present in the Action Area by implementing mitigation measures that include monitoring, ensuring shutdown zones are clear of marine mammals, soft start, and shutdown procedures.
3. Collect data on takes, occurrence, and behavior of marine mammal species in the Action Area and any potential impacts from the project.

2. PROJECT DESCRIPTION

A complete description of the region, project tasks, project materials, dates and duration, affected species, and anticipated impacts are included in the IHA application to which this document is appended. In general terms, the four 30-inch steel pilings forming mooring structure S3 will be removed using a vibratory hammer and relocated a short distance away again using the vibratory hammer with final proofing using an

impact hammer. Both removal and re-installation are each expected to occur over a three-day period within a two-month work window. The total time of active hammering is not expected to exceed five hours.

3. SPECIES COVERED UNDER THE IHA

Whittier is located at the head of Passage Canal, a deep-water fjord within Prince William Sound. The species addressed in the IHA includes those that regularly inhabit the sound including the humpback whale (*Megaptera novaeangliae*), fin whale (*Balaenoptera physalus*), minke whale (*B. acutorostrum*), gray whale (*Eschrichtius robustus*), killer whale (*Orcinus orca*), Pacific white-sided dolphin (*Lagenorhynchus obliquidens*), Dall's porpoise (*Phocoenoides dalli*), harbor porpoise (*Phocoena phocoena*), Steller sea lion (*Eumetopias jubatus*), and harbor seal (*Phoca vitulina*).

The harbor seal is the primary species occurring in Passage Canal that could be expected to inhabit waters near Whittier. Steller sea lions are also found at the head of the canal, but generally during the summer and fall salmon runs, which occur after the proposed spring (February and March) pile driving. Humpback whales and killer whales have been reported annually in the area, and Dall's porpoises have been observed near the mouth of Passage Canal, approximately 17 kilometers (km) (10.6 miles [mi]) east of Whittier. The remaining species are unreported from the inlet or have been observed only once every several years.

4. METHODS

Under directives in the MMPA and the Endangered Species Act (ESA), this 4MP is tailored to the project to ensure appropriate documentation and compliance with applicable regulations. Monitoring will be conducted by qualified, trained protected species observers (PSOs). Land-based PSOs will be located at established sites appropriate for monitoring before, during, and after in-water construction activity to monitor marine mammals within and approaching the shutdown zones and monitoring zones.

During observation periods, PSOs will continuously scan the area for marine mammals using binoculars, spotting scopes, and the naked eye. PSOs will work shifts of a maximum four consecutive hours followed by an observer rotation or a 1-hour break and will work no more than 12 hours in any 24-hour period. However, the maximum pile driving activity that could occur within a given day would last less than two hours over three events providing plenty of time for PSOs to recover from pre-, during-, and post-activity scanning. PSOs will collect data including environmental conditions (e.g., sea state, precipitation, glare), marine mammal sightings (e.g., species, numbers, location, behavior, responses to construction activity), construction activity at the time of sighting, and number of marine mammal exposures (takes). PSOs will conduct observations, meet training requirements, fill out data forms, and report findings in accordance with this 4MP and requirements outlined in the approved IHA.

PSOs will implement mitigation measures including monitoring of the proposed monitoring and shutdown safety zones, ensuring safety zones are clear of marine mammals prior to starting operations, and shutdown procedures are implemented if marine mammals are observed approaching or found within the appropriate shutdown zones. They will be in continuous contact with construction personnel via two-way radio.

A construction contractor employee will be identified as the monitoring coordinator for PSOs at the start of each construction day. PSOs will report directly to the monitoring coordinator when a shutdown is deemed necessary due to marine mammals approaching or within the applicable shutdown safety zones during pile driving or drilling activity.

4.1. Observer Qualifications

Monitoring will be conducted by qualified, trained PSOs. PSOs will be independent (i.e. not construction personnel) and at least one observer will have prior experience working as a marine mammal observer during construction activities. The following requirements must be met for PSOs to be considered qualified:

- Visual acuity in both eyes (correction is permissible) enough for discernment of moving targets at the water's surface with ability to estimate target size and distance.
- Physical capability of performing essential duties, including sitting or standing for periods of up to four hours, using binoculars or other field aids, and documenting observations.
- Experience and ability to conduct field observations and collect data according to assigned protocols.
- Experience or training in the field identification of marine mammals and marine mammal behavior, including the ability to accurately identify marine mammals in Alaskan waters to species.
- Sufficient training, orientation or experience with the construction operation to provide for identification of concurrent activities and for personal safety during observations.
- Writing skills sufficient to prepare reports of observations.
- Ability to communicate orally, by radio and in person, with project personnel to provide real-time information on marine mammals observed in the area and the appropriate mitigation response for the circumstances.

4.2. Data Collection

PSOs will use a NMFS-approved Observation Record (Appendix A) which will be completed by each observer for each survey day and location. Observation Records will be used by PSOs to record the following:

- Date and time that permitted construction activity begins or ends.
- Weather parameters (e.g. percent cloud cover, percent glare, visibility) and sea state (the Beaufort Wind Force Scale will be used to determine sea-state).
- Species, numbers, and, if possible, sex and age class of observed marine mammals.
- Construction activities occurring before, during, and after each sighting.
- Marine mammal behavior patterns observed, including bearing and direction of travel.
- Specific focus should be paid to behavioral reactions just prior to, or during, soft-start and shutdown procedures.

- Location of marine mammal, distance from observer to the marine mammal, and distance from dolphin installation and catwalk construction activities to marine mammals.
- Record of whether an observation required the implementation of mitigation measures, including shutdown procedures and the duration of each shutdown.

4.3. Equipment

The following equipment will be required to conduct observations for this project:

- Appropriate personal protective equipment.
- Portable radios and headsets for the PSOs to communicate with the monitoring coordinator and other PSOs.
- Cellular phone as backup for radio communication.
- Contact information for the other PSOs, monitoring coordinator, and NMFS point of contact.
- Daily tide tables for the Action Area.
- Watch or chronometer.
- Binoculars (quality 7x50 or better) or spotting scope with built-in rangefinder or reticles (rangefinder may be provided separately).
- Hand-held global positioning system (GPS) unit, map and compass, or grid map to record locations of marine mammals.
- Copies of 4MP, IHA, and/or other relevant permit requirement specifications in sealed clear plastic covers.
- Notebook with standardized monitoring Observation Record forms on waterproof paper.

4.4. Shutdown and Monitoring Zones

DOT&PF has established shutdown and monitoring zones to delineate areas in which marine mammals may be exposed to injurious underwater sound levels due to in-water construction. Work which could cause noise levels to rise above non-permitted thresholds will shut down if marine mammals are approaching shutdown zones. PSOs will also monitor and document activities in areas where animals could be subjected to noise levels at or above the permitted thresholds. The zones are summarized below, and their determinations discussed in detail in Section 6 of the IHA request.

The proposed Level B monitoring zone radii and area are summarized in Table 1 and shown in Figure 2, and the hearing-group specific Level A shutdown safety zone radii are provided in Table 2. Figure 3 and Figure 4 show the shutdown safety zones for each marine mammal hearing group for impact and vibratory pile driving, respectively. Selection of the appropriate observation radius depends on concurrent work activities and planned duration. The following apply to both monitoring and safety zones.

- A shutdown safety zone will be established during all over-water construction activities that have the potential to affect marine mammals, and species/activity specific monitoring zones will be

monitored to ensure that animals are not endangered by physical interaction with construction equipment.

- Monitoring and safety zones will be monitored throughout the permitted in-water construction activities.
 - If a permitted marine mammal enters the monitoring zone, an exposure will be recorded, and animal behaviors documented. However, permitted construction activities would continue without cessation unless the animal approaches or enters the applicable shutdown zone.
 - If a marine mammal approaches or enters a shutdown zone, all permitted construction activities will be immediately halted until the marine mammal has been visually observed outside the shutdown zone or 30 minutes have passed without observation.
- Take, in the form of Level B harassment, of marine mammals other than permitted species is not authorized and will be avoided by shutting down construction activities before individuals of these species enter the Level B harassment zone.

4.5. Observer Monitoring Locations

To monitor the shutdown and monitoring zones effectively, PSOs will be positioned at the best practicable vantage points taking into consideration security, safety, access, and space limitations. PSOs will be stationed at locations that provide adequate visual coverage for shutdown and monitoring zones. During the impact hammer installation an observer will be stationed at the end of the ferry terminal catwalk (Station 1, Figure 5), a location that provides a commanding view of the 700 m (2,300-ft) maximum safety zone (Figure 6), and at one station along Shotgun Cove Road (Station 2, Figure 7) located approximately 1.5 km (0.9 mi) from the ferry terminal. During vibratory installation, two additional stations will be located along Shotgun Cove Road and Shotgun Cove Trail (Stations 3 and 4, Figure 7). The proposed locations of the latter three stations are high vantage points allowing full monitoring of the Level B monitoring zones. The view from proposed Station 2 is shown in Figure 8. The station farthest from the terminal (Station 4) is generally accessible all spring via snowmobile. For any portion of the vibratory installation ensonification area that cannot be effectively monitored from these stations (e.g., Poe Bay), potential take will be extrapolated based on marine mammal sightings in the remaining portion of the ensonified area.

4.6. Monitoring Techniques

DOT&PF PSOs will collect sighting data and behaviors of marine mammal species that are observed in the shutdown and monitoring zones during construction. All PSOs will be qualified and trained in marine mammal identification and behaviors, as described in Section 4.1. NMFS requires that the PSOs have no other construction-related tasks while conducting monitoring.

PSOs will actively monitor the shutdown and monitoring zones 30 minutes prior to initiation, during, and 30 minutes post-completion of all permitted activities.

Observation generally requires that natural light conditions are sufficient for PSOs to see the entirety of the monitoring and safety zones; monitoring will commence and be completed during daylight hours to the extent possible.

4.6.1. Pre-Activity Monitoring

The following monitoring methodology will be implemented prior to commencing permitted activities:

- Prior to the start of permitted activities, PSOs will monitor the monitoring and safety zones for 30 minutes. They will ensure that no marine mammals are present within the shutdown zones before permitted activities begin.
- The shutdown zones will be considered “clear” of when marine mammals have not been observed within the zone for that 30-minute period. If a marine mammal is observed within the applicable shutdown zone, a soft-start cannot proceed until the animal has left the zone or has not been observed for 15 minutes (for pinnipeds and cetaceans).
- After all applicable shutdown zones have been cleared, the PSOs will radio the monitoring coordinator. Permitted activities will not commence until the monitoring coordinator receives verbal confirmation the zones are clear.
- If permitted species are present within the monitoring zone, work will not be delayed, but PSOs will monitor and document the behavior of individuals that remain in the monitoring zone. Delay will occur however if the authorized take quota is close to being reached.
- In case of fog or reduced visibility, PSOs must be able to see the entirety of shutdown and monitoring zones before permitted activities can be initiated.

4.6.2. Soft Start Procedures

Soft start procedures will be initiated prior to periods of pile installation to allow marine mammals to leave the area before exposure to maximum noise levels.

- For vibratory hammers, the contractor shall run the hammer for no more than 30 seconds followed by a quiet period of at least 60 seconds without hammering. The process shall be repeated twice more within 10 minutes before beginning driving operations that last longer than 30 seconds.
- For impact hammers, the soft start technique will initiate several strikes at a reduced energy level, followed by a brief waiting period. This procedure would be repeated two additional times.
- If work ceases for more than 30 minutes, zone clearance (see Section 4.6.1) and soft start procedures must recommence prior to performing additional work.

4.6.3. During-Activity Monitoring

The following monitoring methodology will be implemented during permitted activities:

- If permitted species are observed within the monitoring zone during permitted activities, an exposure will be recorded, and behaviors documented. Work will not stop unless an animal enters or appears likely to enter the applicable shutdown zone.

4.6.4. Inclement Weather

During inclement weather or periods of limited visibility, work that has begun with a fully cleared observation zone may continue. In those cases, an assumed rate of observation similar to the daily average

rate of observation will be used to estimate the number of sightings to be reported during those periods. This method will only be used if the full observation zone was visible during the start of work and no shutdowns greater than 30 minutes have occurred.

4.6.5. Shutdown

If a marine mammal enters or appears likely to enter the shutdown zone:

- PSOs shall immediately radio or call to alert the monitoring coordinator.
- All permitted activities will be immediately halted.
- In the event of a shutdown of pile installation operations, permitted activities may resume only when:
 - The animal(s) within or approaching the shutdown zone has been visually confirmed beyond or heading away from the shutdown zone, or 15 minutes (for pinnipeds) or 30 minutes (for cetaceans) have passed without re-detection of the animal.
 - PSOs will then radio or call the monitoring coordinator that activities can re-commence.

4.6.6. Breaks in Work

During an in-water construction delay, the shutdown and monitoring zones will continue to be monitored unless the break extends into several hours. No exposures will be recorded for permitted species in the monitoring zone if there are no concurrent permitted construction activities.

If permitted activities cease for more than 1 hour and monitoring has not continued, pre-activity monitoring (Section 4.6.1) and soft start procedures (Section 4.6.2) must recommence. This includes breaks due to scheduled or unforeseen construction practices or breaks due to permit-required shutdown. Following 15 minutes (for pinnipeds) or 30 minutes (for cetaceans) of monitoring, work can begin according to the pre-activity monitoring protocols. Work cannot begin if an animal is within the shutdown zone or if visibility is not clear throughout the shutdown and monitoring zones.

4.6.7. Post-Activity Monitoring

Monitoring of the shutdown and monitoring zones will continue for 30 minutes following completion of pile installation activities. These surveys will record observations focused on observing and reporting unusual or abnormal behavior of marine mammals.

5. REPORTING

5.1. Injured or Dead Marine Mammal

If DOT&PF finds an injured, sick, or dead marine mammal, a representative will notify NMFS and provide the species or description of the animal(s), condition of the animal or carcass, location, date and time of first discovery, observed behaviors (if alive), and photograph or video (if available).

- If the marine mammal's condition is a direct result of the project, notification to NMFS will be made and work will stop until NMFS is able to review the circumstances of the prohibited take.

- If the lead observer determines that the injury or death is not associated with or related to the activities authorized in the IHA (e.g., previously wounded animal, carcass with moderate to advanced decomposition, scavenger damage), DOT&PF shall report the incident within 24 hours of the discovery. Construction activities may continue while NMFS reviews the circumstances of the incident and makes a final determination on the cause of the reported injury or death.
- If cause of death is unclear, DOT&PF shall immediately report the incident. Construction activities may continue while NMFS reviews the circumstances of the incident and makes a final determination on the cause of the reported injury or death. NMFS will work with DOT&PF to determine whether additional mitigation measures or modifications to the activities are appropriate.

Reports will be made to the Office of Protected Resources and the Alaska Regional Stranding Coordinator.

5.2. Annual Report

A comprehensive annual marine mammal monitoring report documenting marine mammal observations will be submitted to NMFS at the end of the in-water work season. The draft report will be submitted to NMFS within 90 calendar days of the end of the in-water work period. The report will include marine mammal observations (pre-activity, during-activity, and post-activity) during in-water work. A final comprehensive report will be prepared and submitted to NMFS within 30 calendar days following resolution of comments on the draft report from NMFS.

The reports shall include at a minimum:

- General data:
 - Date and time of activity
 - Water conditions (e.g., sea-state)
 - Weather conditions (e.g., percent cover, percent glare, visibility)
- Specific pile driving data:
 - Coordinated effort by the construction contractor and/or marine mammal monitoring staff to ensure that pile driving/drilling times (including strike counts) are accurately recorded. The duration of soft start procedures should be noted as separate from the full power duration.
 - Description of in-water construction activity not involving pile driving/drilling (location, type of activity, onset and completion times).
- Pre-activity monitoring data:
 - Date and time permitted activity is initiated and terminated.
 - Description of any observable marine mammals and their behavior in the immediate area during monitoring.
 - Times when in-water construction is delayed due to presence of marine mammals within shutdown zones.

- During-activity monitoring data:
 - Description of any observable marine mammal behavior within monitoring zones or in the immediate area surrounding the monitoring zones, including the following:
 - Distance from animal to pile driving/drilling sound source.
 - Reason why/why not shutdown implemented.
 - If a shutdown was implemented, behavioral reactions noted and if they occurred before or after implementation of the shutdown;
 - If a shutdown was implemented, the distance from animal to sound source at the time of the shutdown.
 - Behavioral reactions noted during soft starts and if they occurred before or after implementation of the soft start;
 - Distance to the animal from the sound source during soft start.
 - Description of pile activities completed.
- Post-activity monitoring data:
 - Results, which include the detections and behavioral reactions of marine mammals, the species and numbers observed, sighting rates and distances.
 - Refined exposure estimate based on the number of marine mammals observed. This may be reported as a rate of take (number of marine mammals per hour or per day) or using some other appropriate metric.

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TABLES

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Table 1. Level B monitoring and safety zone radii and area.

Source	Level B Monitoring Zone Radius (km)	Level B Monitoring Zone Area (km²)
Impact Hammer	1.2	3.7
Vibratory Hammer	12.0	20.5

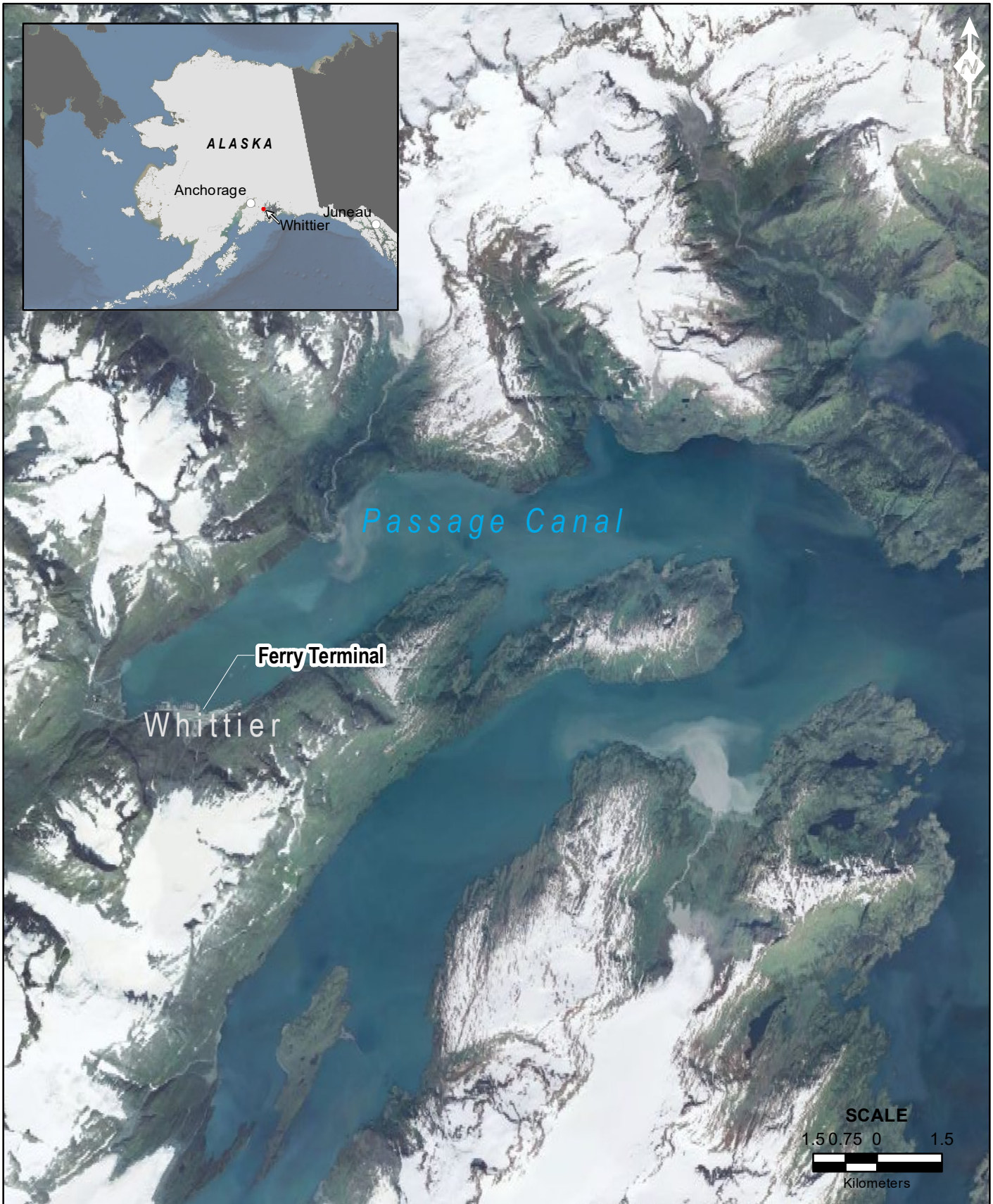
Table 2. Level A safety zone radii.

Hearing Group	Representative Species	Impact Safety Zone (m)	Vibratory Safety Zone (m)
Low Frequency Cetaceans	Humpback Whale	550	50
Mid Frequency Cetaceans	Killer Whale	25	50
High Frequency Cetaceans	Harbor Porpoise	700	50
Phocid Pinnipeds	Harbor Seal	300	50
Otariid Pinnipeds	Steller Sea Lion	25	50

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FIGURES

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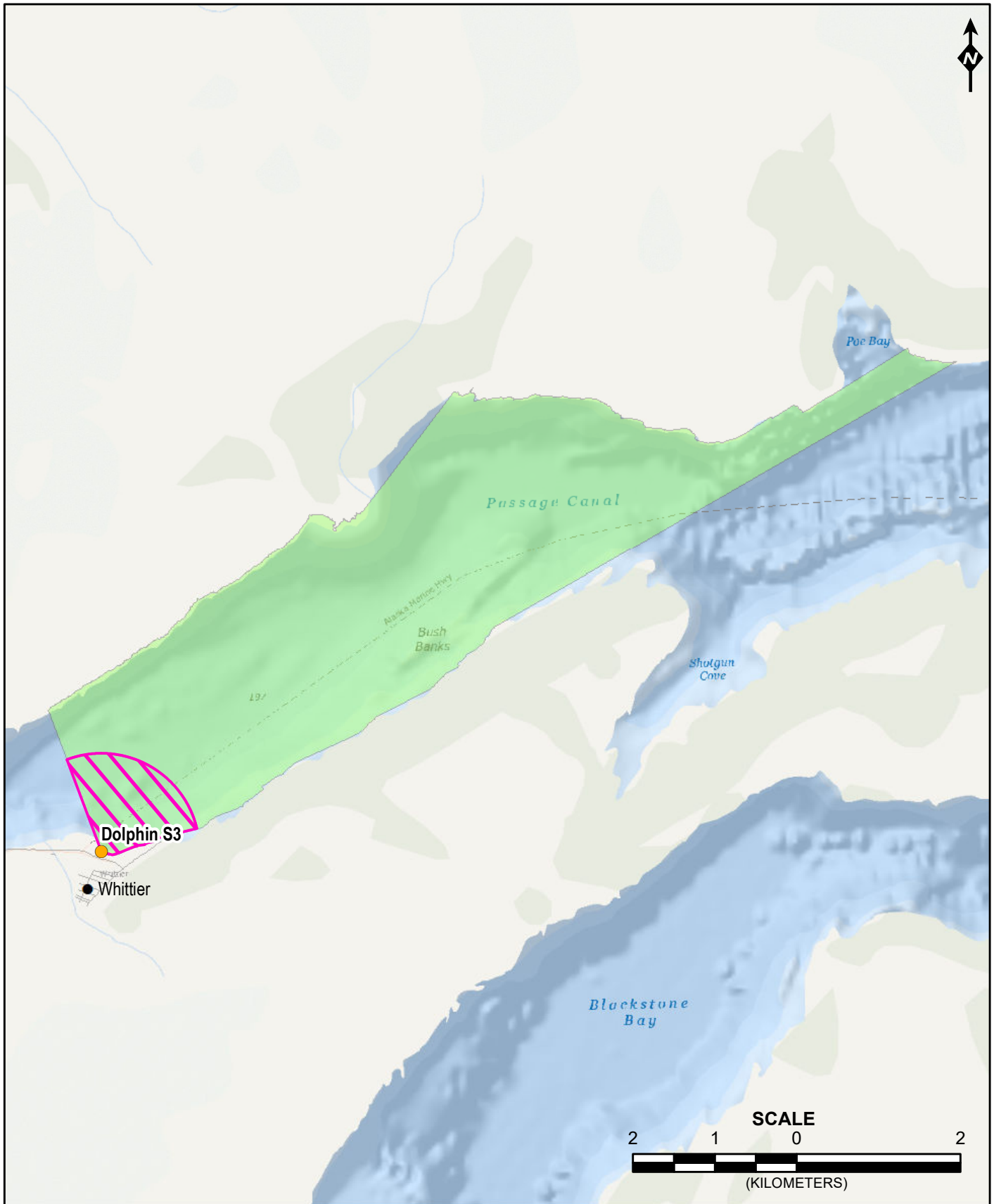


FERRY TERMINAL LOCATION

Whittier Ferry Terminal ACF Modifications
Alaska Department of Transportation
& Public Facilities

DATE: 7/23/2019

FIGURE: 1

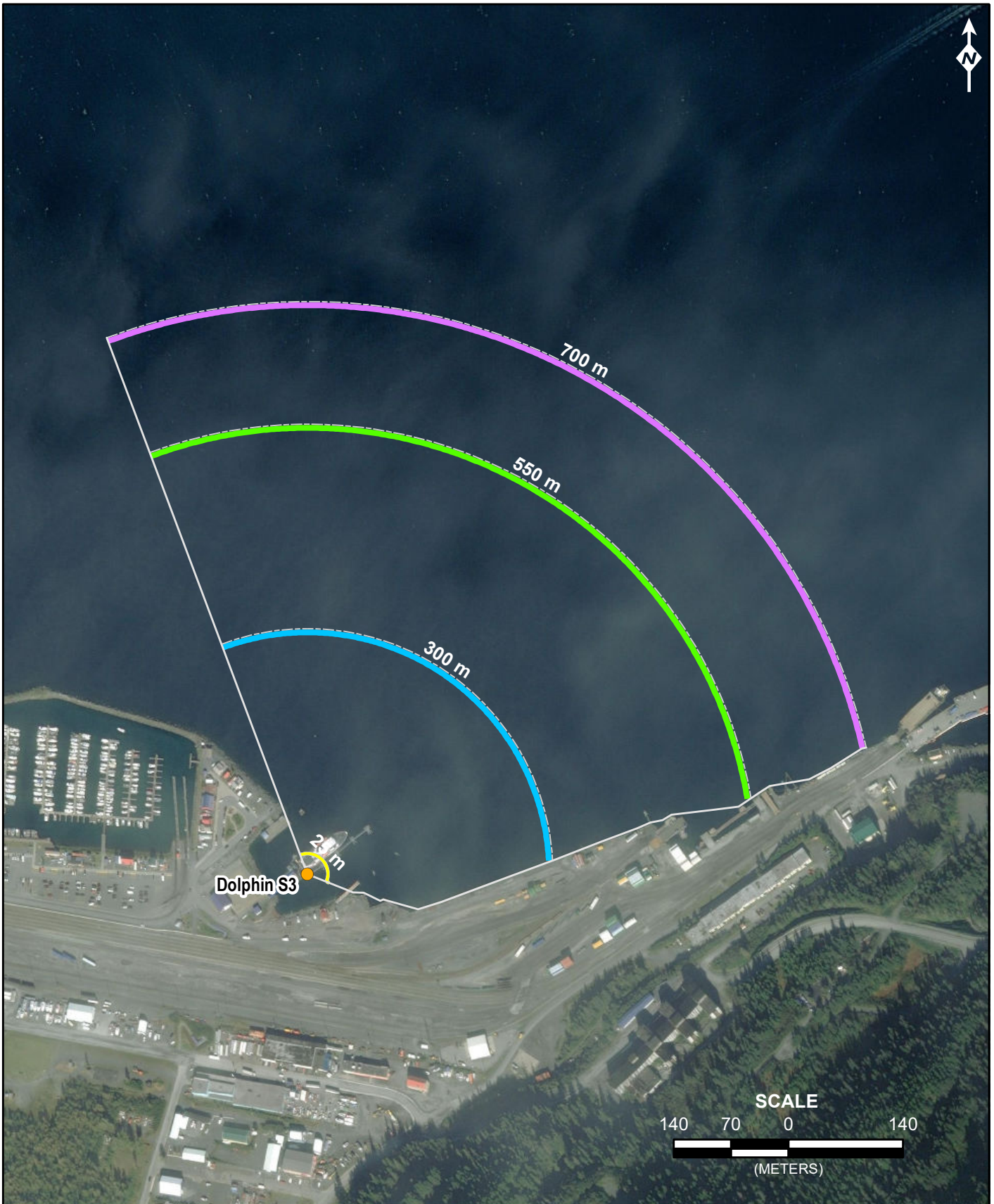


● Sound Source at Dolphin S3

Ensonification Distance

- ▨ 1.2 km - Impact Monitoring Zone
- 12.0 km - Vibratory Monitoring Zone (Maximum Ensonification Area)

IMPACT AND VIBRATORY PILE DRIVING LEVEL B ENSONIFIED AREA Whittier Ferry Terminal ACF Modifications Alaska Department of Transportation & Public Facilities	
DATE: 08/26/2019	FIGURE: 2



● Sound Source at Dolphin S3

Hearing Group

- Mid Frequency Cetaceans (Killer Whale) & Otariid Pinnipeds (Stellar Sea Lion) - 25 m
- Phocid Pinnipeds (Harbor Seal) – 300 m
- Low-Frequency Cetaceans (Humpback Whale) – 550 m
- High-Frequency Cetaceans (Harbor Porpoise) – 700 m

LEVEL A SHUTDOWN SAFETY ZONES DURING IMPACT PILE DRIVING

Whittier Ferry Terminal ACF Modifications
Alaska Department of Transportation
& Public Facilities

DATE: **08/26/2019**

FIGURE: **3**

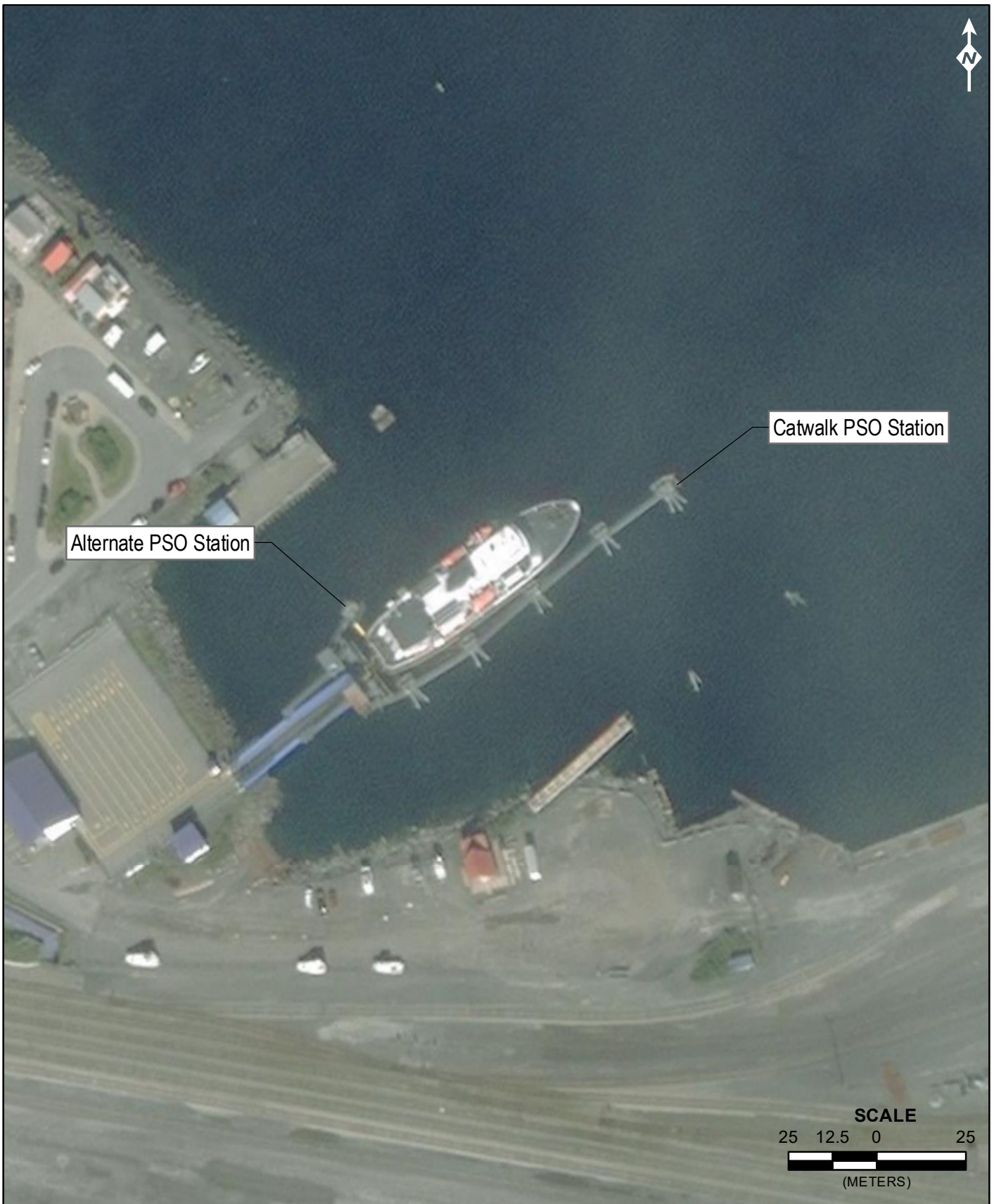


- Sound Source at Dolphin S3
- - - Level A Safety Zone - 50 m

**LEVEL A SHUTDOWN SAFETY ZONES
DURING VIBRATORY PILE DRIVING**
Whittier Ferry Terminal ACF Modifications
Alaska Department of Transportation
& Public Facilities

DATE: **07/23/2019**

FIGURE: **4**



PSO STATION 1 (CATWALK) LOCATION

Whittier Ferry Terminal ACF Modifications
Alaska Department of Transportation
& Public Facilities

DATE: **07/23/2019**

FIGURE: **5**



PSO Station 1
(Catwalk)

PSO STATION 1 (CATWALK)

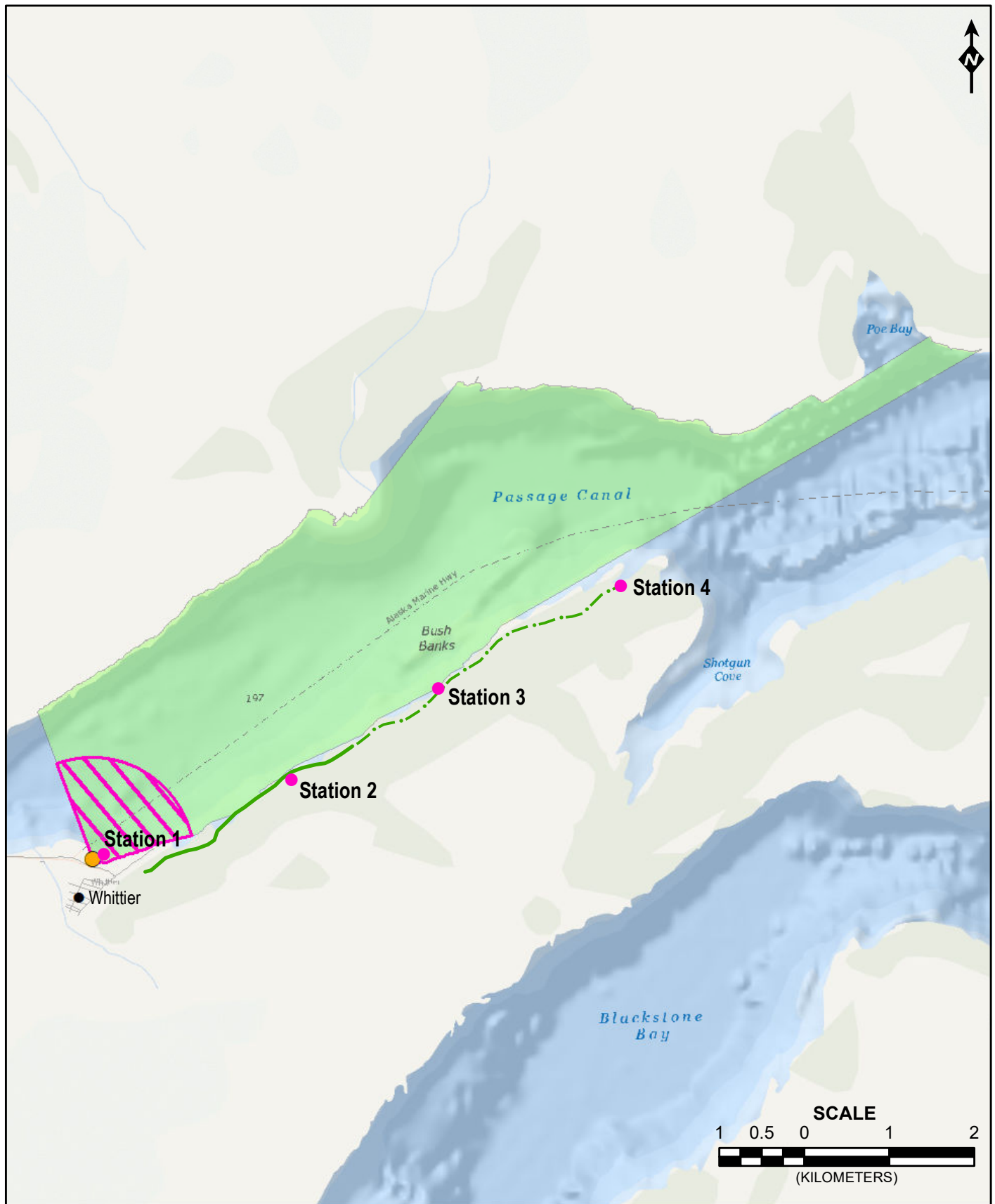
Whittier Ferry Terminal ACF Modifications
Alaska Department of Transportation
& Public Facilities

FIGURE:

6

DATE:

06/04/2019



- PSO Stations
- Sound Source at Dolphin S3
- Shotgun Cove Road
- - - Shotgun Cove Trail

Ensonification Distance

- 1.2 km - Impact Monitoring Zone
- 12.0 km - Vibratory Monitoring Zone (Maximum Ensonification Area)

**IMPACT AND VIBRATORY PILE DRIVING
LEVEL B ENSONIFIED AREA ISOPLETHS**

Whittier Ferry Terminal ACF Modifications
Alaska Department of Transportation
& Public Facilities

DATE: **08/26/2019**

FIGURE: **7**



**VIEW OF PASSAGE CANAL
FROM PSO STATION 2**

Whittier Ferry Terminal ACF Modifications
Alaska Department of Transportation
& Public Facilities

FIGURE:

8

DATE:

06/04/2019

APPENDIX A

Marine Mammal Observation Record Form

MARINE MAMMAL OBSERVATION RECORD

Project Name: _____

Monitoring Location: _____

Date: _____

Time Effort Initiated: _____

Time Effort Completed: _____

Page _____ of _____

Time	Visibility	Glare	Weather Condition	Wave Height	BSS	Wind	Swell
:	B - P - M - G - E	%	S - PC - L - R - F - OC - SN - HR	Lt/Mod/Hvy		N S E W	N S E W
:	B - P - M - G - E	%	S - PC - L - R - F - OC - SN - HR	Lt/Mod/Hvy		N S E W	N S E W
:	B - P - M - G - E	%	S - PC - L - R - F - OC - SN - HR	Lt/Mod/Hvy		N S E W	N S E W
:	B - P - M - G - E	%	S - PC - L - R - F - OC - SN - HR	Lt/Mod/Hvy		N S E W	N S E W
:	B - P - M - G - E	%	S - PC - L - R - F - OC - SN - HR	Lt/Mod/Hvy		N S E W	N S E W
:	B - P - M - G - E	%	S - PC - L - R - F - OC - SN - HR	Lt/Mod/Hvy		N S E W	N S E W

Event Code	Sight # (1 or 1.1 if re- sight)	Time/Dur (Start/End time if cont.)	WP/ Grid #/ DIR of travel	Zone/ Radius/ Impact Pile #?	Obs.	Sighting Cue	Species	Group Size	Behavior Code (see code sheet)	Construction Type	Mitigation Type	Exposure (Y/N)	Behavior Change/ Response to Activity/Comments/Human Activity/Vessel Hull # or Name/ Visibility Notes
E ON PRE/POST CON S M OR E OFF		:	Grid N or S W or E			BL BO BR DF SA OTHER		Min: Max: Best:		SSV SSI V DR I DP ST OWC NOWC / NONE	SS/BC DE SD None		
E ON PRE/POST CON S M OR E OFF		:	Grid N or S W or E			BL BO BR DF SA OTHER		Min: Max: Best:		SSV SSI V DR I DP ST OWC NOWC / NONE	SS/BC DE SD None		
E ON PRE/POST CON S M OR E OFF		:	Grid N or S W or E			BL BO BR DF SA OTHER		Min: Max: Best:		SSV SSI V DR I DP ST OWC NOWC / NONE	SS/BC DE SD None		
E ON PRE/POST CON S M OR E OFF		:	Grid N or S W or E			BL BO BR DF SA OTHER		Min: Max: Best:		SSV SSI V DR I DP ST OWC NOWC / NONE	SS/BC DE SD None		
E ON PRE/POST CON S M OR E OFF		:	Grid N or S W or E			BL BO BR DF SA OTHER		Min: Max: Best:		SSV SSI V DR I DP ST OWC NOWC / NONE	SS/BC DE SD None		
E ON PRE/POST CON S M OR E OFF		:	Grid N or S W or E			BL BO BR DF SA OTHER		Min: Max: Best:		SSV SSI V DR I DP ST OWC NOWC / NONE	SS/BC DE SD None		
E ON PRE/POST CON S M OR E OFF		:	Grid N or S W or E			BL BO BR DF SA OTHER		Min: Max: Best:		SSV SSI V DR I DP ST OWC NOWC / NONE	SS/BC DE SD None		
E ON PRE/POST CON S M OR E OFF		:	Grid N or S W or E			BL BO BR DF SA OTHER		Min: Max: Best:		SSV SSI V DR I DP ST OWC NOWC / NONE	SS/BC DE SD None		

Marine Mammal Observation Record – Sighting Codes

Code	Behavior	Definition
BR	Breaching	Leaps clear of water
CD	Change Direction	Suddenly changes direction of travel
CH	Chuff	Makes loud, forceful exhalation of air at surface
DI	Dive	Forward dives below surface
DE	Dead	Shows decomposition or is confirmed as dead by investigation
DS	Disorientation	An individual displaying multiple behaviors that have no clear direction or purpose
FI	Fight	Agonistic interactions between two or more individuals
FO	Foraging	Confirmed by food seen in mouth
MI	Milling	Moving slowly at surface, changing direction often, not moving in any particular direction
PL	Play	Behavior that does not seem to be directed towards a particular goal; may involve one, two or more individuals
PO	Porpoising	Moving rapidly with body breaking surface of water
SL	Slap	Vigorously slaps surface of water with body, flippers, tail etc.
SP	Spyhopping	Rises vertically in the water to "look" above the water
SW	Swimming	General progress in a direction. Note general direction of travel when last seen [Example: "SW (N)" for swimming north]
TR	Traveling	Traveling in an obvious direction. Note direction of travel when last seen [Example: "TR (N)" for traveling north]
UN	Unknown	Behavior of animal undetermined, does not fit into another behavior
AWA	Approach Work	
LWA	Leave Work Area	
Pinniped only		
EW	Enter Water (from haul out)	Enters water from a haul-out for no obvious reason
FL	Flush (from haul out)	Enters water in response to disturbance
HO	Haul out (from water)	Hauls out on land
RE	Resting	Resting onshore or on surface of water
LO	Look	Is upright in water "looking" in several directions or at a single focus
SI	Sink	Sinks out of sight below surface without obvious effort (usually from an upright position)
VO	Vocalizing	Animal emits barks, squeals, etc.
Cetacean only		
LG	Logging	Resting on surface of water with no obvious signs of movement

Sea State and Wave Height: Use Beaufort Sea State Scale for Sea State. This refers to the surface layer and whether it is glassy in appearance or full of white caps. In the open ocean, it also considers the wave height or swell, but in inland waters the wave height (swells) may never reach the levels that correspond to the correct surface white cap number. Therefore, include wave height for clarity.

Glare: Percent glare should be the total glare of PSOs' area of responsibility. Determine if observer coverage is covering 90 degrees or 180 degrees and document daily. Then assess total glare for that area. This will provide needed information on what percentage of the field of view was poor due to glare.

Swell Direction: Swell direction should be where the swell is coming from (S for coming from the south). If possible, record direction relative to fixed location (pier). Choose this location at beginning of monitoring project.

Wind Direction: Wind direction should also be where the wind is coming from.

Event

Code	Activity Type
E ON	Effort On
E OFF	Effort Off
PRE	Pre-Construction Watch
POST	Post-Construction Watch
CON	Construction (see types)
S	Sighting
M	Mitigation (see types)
OR	Observer Rotation

Sighting Cues

Code	Distance Visible
BL	Blow
BO	Body
BR	Breach
DF	Dorsal Fin
SA	Surface Activity
OTHR	Other

Marine Mammal Species

Code	Marine Mammal Species
HSEA	Harbor Seal
STSL	Steller Sea Lion
HPBK	Humpback Whale
HAPO	Harbor Porpoise
DAPO	Dall's Porpoise
MINK	Minke Whale
ORCA	Killer Whale

Construction Type

Code	Activity Type
V	Vibratory Pile Driving
I	Impact Pile Driving
ST	Stabbing
DR	Drilling

Code	Activity Type
OWC	Over-Water Construction
NOWC	No Over-Water Construction
NONE	No Construction

Mitigation Codes

Code	Activity Type
SS	Soft Start
BC	Bubble Curtain
DE	Delay onset of In-Water Work
SD	Shut down In-Water Work

Visibility

Code	Distance Visible
B	Bad (<0.5km)
P	Poor (0.5 – 0.9km)
M	Moderate (0.9 – 3km)
G	Good (3 - 10km)
E	Excellent (>10km)

Weather Conditions

Code	Weather Condition
S	Sunny
PC	Partly Cloudy
L	Light Rain
R	Steady Rain
F	Fog
OC	Overcast
SN	Snow
HR	Heavy Rain

Wave Height

Code	Wave Height
Light	0 – 3 ft
Moderate	4 – 6 ft
Heavy	>6 ft

APPENDIX B

Acoustical Calculation User Spreadsheets

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A.1: Vibratory Pile Driving (STATIONARY SOURCE: Non-Impulsive, Continuous)

VERSION 2.0: 2018

KEY

	User Provided Information
	NMFS Provided Information (Technical Guidance)
	Resultant Isopleth

STEP 1: GENERAL PROJECT INFORMATION

PROJECT TITLE	Whittier Ferry Terminal Improvement
PROJECT/SOURCE INFORMATION	DOT&PF Southcoast Region

Please include any assumptions

PROJECT CONTACT	Christy Gentemann (907) 465-4524
-----------------	-------------------------------------

STEP 2: WEIGHTING FACTOR ADJUSTMENT

Weighting Factor Adjustment (kHz)*	2.5	
------------------------------------	-----	--

Specify if relying on source-specific WFA, alternative weighting/dB adjustment, or if using default value

* Broadband: 95% frequency contour percentile (kHz) OR Narrowband: frequency (kHz); For appropriate default WFA: See INTRODUCTION tab

† If a user relies on alternative weighting/dB adjustment rather than relying upon the WFA (source-specific or default), they may override the Adjustment (dB) (row 48), and enter the new value directly. However, they must provide additional support and documentation supporting this modification.

* **BROADBAND Sources: Cannot use WFA higher than maximum applicable frequency (See GRAY tab for more information on WFA applicable frequencies)**

STEP 3: SOURCE-SPECIFIC INFORMATION

Source Level (RMS SPL)	168
Number of piles within 24-h period	1.5
Duration to drive a single pile (minutes)	45
Duration of Sound Production within 24-h period (seconds)	4050
10 Log (duration of sound production)	36.07
Propagation (xLogR)	15
Distance from source level measurement (meters)*	10

*Unless otherwise specified, source levels are referenced 1 m from the source.

NOTE: The User Spreadsheet tool provides a means to estimate distances associated with the Technical Guidance's PTS onset thresholds. Mitigation and monitoring requirements associated with a Marine Mammal Protection Act (MMPA) authorization or an Endangered Species Act (ESA) consultation or permit are independent management decisions made in the context of the proposed activity and comprehensive effects analysis, and are beyond the scope of the Technical Guidance and the User Spreadsheet tool.

RESULTANT ISOPLETHS

Hearing Group	Low-Frequency Cetaceans	Mid-Frequency Cetaceans	High-Frequency Cetaceans	Phocid Pinnipeds	Otariid Pinnipeds
SEL _{cum} Threshold	199	198	173	201	219
PTS isopleth to threshold (meters)	21.6	1.9	32.0	13.2	0.9

WEIGHTING FUNCTION CALCULATIONS

Weighting Function Parameters	Low-Frequency Cetaceans	Mid-Frequency Cetaceans	High-Frequency Cetaceans	Phocid Pinnipeds	Otariid Pinnipeds
a	1	1.6	1.8	1	2
b	2	2	2	2	2
f ₁	0.2	8.8	12	1.9	0.94
f ₂	19	110	140	30	25
C	0.13	1.2	1.36	0.75	0.64
Adjustment (dB)†	-0.05	-16.83	-23.50	-1.29	-0.60

$$W(f) = C + 10 \log_{10} \left\{ \frac{(f/f_1)^{2a}}{[1 + (f/f_1)^2]^a [1 + (f/f_2)^2]^b} \right\}$$

E.1: IMPACT PILE DRIVING (STATIONARY SOURCE: Impulsive, Intermittent)

VERSION 2.0: 2018

KEY

	User Provided Information
	NMFS Provided Information (Technical Guidance)
	Resultant Isopleth

STEP 1: GENERAL PROJECT INFORMATION

PROJECT TITLE	Whittier Ferry Terminal Improvement
PROJECT/SOURCE INFORMATION	DOT&PF Southcoast Region

Please include any assumptions

PROJECT CONTACT	Christy Gentemann (907) 465-4524
-----------------	-------------------------------------

STEP 2: WEIGHTING FACTOR ADJUSTMENT

Weighting Factor Adjustment (kHz)*	2	
------------------------------------	---	--

Specify if relying on source-specific WFA, alternative weighting/dB adjustment, or if using default value

* Broadband: 95% frequency contour percentile (kHz) OR Narrowband: frequency (kHz); For appropriate default WFA: See INTRODUCTION tab

† If a user relies on alternative weighting/dB adjustment rather than relying upon the WFA (source-specific or default), they may override the Adjustment (dB) (row 75), and enter the new value directly. However, they must provide additional support and documentation supporting this modification.

*** BROADBAND Sources: Cannot use WFA higher than maximum applicable frequency (See GRAY tab for more information on WFA applicable frequencies)**

STEP 3: SOURCE-SPECIFIC INFORMATION

NOTE: Choose either E1-1 OR E.1-2 method to calculate isopleths (not required to fill in sage boxes for both)

E.1-1: METHOD TO CALCULATE PK AND SEL_{cum} (USING RMS SPL SOURCE LEVEL)

SEL_{cum}

Source Level (RMS SPL)	191.3
Number of piles per day	1.5
Strike Duration ^A (seconds)	0.1
Number of strikes per pile	400
Duration of Sound Production (seconds)	60
10 Log (duration of sound production)	17.78
Propagation (xLogR)	15
Distance of source level measurement (meters)*	10

^AWindow that makes up 90% of total cumulative energy (5%-95%) based on Madsen 2005

*Unless otherwise specified, source levels are referenced 1 m from the source.

PK

Source Level (PK SPL)	206
Distance of source level measurement (meters)*	10
Source level at 1 meter	221.0

*Unless otherwise specified, source levels are referenced 1 m from the source.

NOTE: The User Spreadsheet tool provides a means to estimates distances associated with the Technical Guidance's PTS onset thresholds. Mitigation and monitoring requirements associated with a Marine Mammal Protection Act (MMPA) authorization or an Endangered Species Act (ESA) consultation or permit are independent management decisions made in the context of the proposed activity and comprehensive effects analysis, and are beyond the scope of the Technical Guidance and the User Spreadsheet tool.

RESULTANT ISOPLETHS*

*Impulsive sounds have dual metric thresholds (SEL_{cum} & PK). Metric producing largest isopleth should be used.

Hearing Group	Low-Frequency Cetaceans	Mid-Frequency Cetaceans	High-Frequency Cetaceans	Phocid Pinnipeds	Otariid Pinnipeds
SEL _{cum} Threshold	183	185	155	185	203
PTS isopleth to threshold (meters)	547.2	19.5	651.8	292.9	21.3
PK Threshold	219	230	202	218	232
PTS PK isopleth to threshold (meters)	1.4	NA	18.5	1.6	NA

E.1-2: ALTERNATIVE METHOD TO CALCULATE PK AND SEL_{cum} (SINGLE STRIKE EQUIVALENT)

Unweighted SEL_{cum} (at measured distance) = SEL_{ss}
+ 10 Log (# strikes)

#NUM!

SEL_{cum}

Source Level (Single Strike SEL)	
Number of strikes per pile	
Number of piles per day	
Propagation (xLogR)	
Distance of single strike SEL measurement (meters)*	

*Unless otherwise specified, source levels are referenced 1 m from the source.

PK

Source Level (PK SPL)	
Distance of source level measurement (meters)*	
Source level at 1 meter	#NUM!

*Unless otherwise specified, source levels are referenced 1 m from the source.

RESULTANT ISOPLETHS*

*Impulsive sounds have dual metric thresholds (SEL_{cum} & PK). Metric producing largest isopleth should be used.

Hearing Group	Low-Frequency Cetaceans	Mid-Frequency Cetaceans	High-Frequency Cetaceans	Phocid Pinnipeds	Otariid Pinnipeds
SEL _{cum} Threshold	183	185	155	185	203
PTS isopleth to threshold (meters)	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!
PK Threshold	219	230	202	218	232
PTS PK isopleth to threshold (meters)	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!

WEIGHTING FUNCTION CALCULATIONS

Weighting Function Parameters	Low-Frequency Cetaceans	Mid-Frequency Cetaceans	High-Frequency Cetaceans	Phocid Pinnipeds	Otariid Pinnipeds
a	1	1.6	1.8	1	2
b	2	2	2	2	2
f ₁	0.2	8.8	12	1.9	0.94
f ₂	19	110	140	30	25
C	0.13	1.2	1.36	0.75	0.64
Adjustment (dB)†	-0.01	-19.74	-26.87	-2.08	-1.15

$$W(f) = C + 10 \log_{10} \left\{ \frac{(f/f_1)^{2a}}{[1 + (f/f_1)^2]^a [1 + (f/f_2)^2]^b} \right\}$$