FINAL

Request for Incidental Harassment Authorization

Haines Ferry Terminal Improvements

Haines, Alaska

Prepared for:

Alaska Department of Transportation and Public Facilities

Project Number Z684640000

And

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1. DESCRIPTION OF THE ACTIVITY

1.1. Introduction

The Alaska Department of Transportation and Public Facilities (Alaska DOT&PF), in cooperation with the Alaska Division of the Federal Highway Administration (FHWA) is proposing to construct an Alaska Marine Highway System (AMHS) End Berth Facility at the Haines Ferry Terminal (Terminal) in Haines, Alaska (Haines Ferry Terminal Modification Project, STIP # Z684640000, hereafter referred to as the Project). Re-configuration of the Terminal at Haines, Alaska (Lutak Dock) is one of several federally-funded projects identified within the Statewide Transportation Improvement Program (STIP) for fiscal years 2016-2019. [1]

Because it is federally funded, the Project is subject to review and the requirements of federal environmental statutes and regulations including the Marine Mammal Protection Act (MMPA) and the Endangered Species Act (ESA). The MMPA prohibits the "taking"[2] of marine mammals except under certain situations. Sections 101 (a) (5)(D) of the MMPA allows for the issuance of an Incidental Harassment Authorization (IHA), provided an activity results in negligible impacts on marine mammals and would not adversely affect subsistence use of these animals.

The proposed Project would occur in marine waters that support several marine mammal species. The timing and duration of specific Project-related activities may result in the incidental taking by acoustical harassment of marine mammals protected under the MMPA. Incidental take is an unintentional, but not unexpected, "take" of a marine mammal. Therefore, Alaska DOT&PF is requesting an IHA for takes of the following marine mammal species that may occur in the vicinity of the Project: harbor seal, Steller sea lion, humpback whale, killer whale, harbor porpoise and Dall's porpoise. The construction and reconfiguration of the Terminal has the potential to take marine mammals by harassment, is not expected to result in a serious injury or a mortality of any marine mammal, and would be completed within a 12-month period of time. Specifically, Alaska DOT&PF is requesting that National Marine Fisheries Service (NMFS) issue an IHA, beginning approximately April 2018, allowing non-lethal taking of small numbers of marine mammals by harassment incidental to the proposed activities that would be conducted during all construction and reconfiguration phases of the Project. This request is submitted pursuant to Section 101 (a) (5) (D) of the MMPA, 16 USC 1371.101 (a) (5), and 50 CFR 216, Subpart I.

1.2. Proposed Action

The Alaska DOT&PF proposes to reconfigure the current Terminal by:

[1] State of Alaska. 2015. Statewide Transportation Improvement Plan (STIP), 2016-2019, Department of Transportation and Public Facilities (DOT&PF), P.O.Box 112500, 3132 Channel Drive, Suite 200, Juneau, Alaska 99811, 290 pp. Approved November 27, 2015.

[2] "Take" is defined under the MMPA (16 USC 1362) and further defined by regulation (at 50 CFR 216.3) as "to harass, hunt, capture, collect, or kill, or attempt to harass, hunt, capture, collect, or kill any marine mammal. Take is further defined under the ESA as "to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect, or to attempt to engage in any such conduct."

- Demolishing and removing an existing four-pile structure. These piles would need to be removed by vibratory methods. Assuming two 30-in. diameter piles could be removed each day, in addition to one day for unexpected delays, the removal process would take two days.
- Dredging to -30 Mean Low Low Water (MLLW) to provide sufficient water depths for vessel mooring (some dredging was completed in 2015);
- Placing riprap slope protection at proposed dredge slope,
- Installing infrastructure including:
  - Concrete mooring and vehicle transfer float,
  - Restraint structures (two four-pile restraint structures and one seven-pile restraint structure),
  - Two steel transfer bridges and associated abutment and bearing structures,
  - Four four-pile and one six-pile mooring and berthing structures,
  - Personnel access catwalks and gangways,
  - Passenger waiting shelter,
  - Electrical components for marine and upland areas.

The planned infrastructure would extend the structure to the south and require the installation of 37 new in-water piles (ADOT&PF 2016a). Fifteen of the new piles would be 36-inch (in.) diameter with 1 in. wall thickness, and 22 would be 30-in. diameter, ¾ in. thickness. In addition, the staging areas would be paved and striped. Appendix A provides the Preliminary Project Description.

1.2.1. Description of the Action Area

The Terminal is located near the mouth of Lutak Inlet, approximately four miles north of the town of Haines, in northern Southeast Alaska at 59°16'54"N, 135°27'44.6"W (Figure 1-1). The Terminal is a multi-use dock used by AMHS mainline and fast ferries, Alaska Marine Lines (AML) (tug and barge), and Delta Western (tug and barge). It is the second busiest AMHS port of call and can see up to four ferries coming and going during any given day in summer. The AMHS provides a transportation link for Alaska residents and businesses, as well as for non-residents visiting the state.

Alaska DOT&PF considers the Action Area for this Project distinct from, and larger than, the immediate footprint of the Terminal because some elements of the Project may affect marine mammal species at some distance. Therefore, for purposes of this IHA application, the Action Area is defined consistent with ESA regulations[3] as the area within which all direct and indirect effects of the Project would occur. The Action Area, therefore, extends out to a point where no measurable effects from the Project are expected to occur. This area includes the area radiating from the Terminal out to a distance where marine mammals are no longer affected by the underwater and in-air sounds produced by the Project that might result in Level B “takes” (behavioral disturbance or harassment) to marine mammals, and consistent with NMFS acoustic injury guidelines (NMFS 2016)[4].

[3] at 50 CFR 402.0
[4] The NMFS acoustic injury guidelines are located at (http://www.nmfs.noaa.gov/pr/acoustics/guidelines.htm)

Also, the work may include some dredging to provide sufficient water depths along the face of the berth for safe vessel use. Therefore, a dredged material disposal site at Taiya Inlet, approximately 5.6 kilometers (km) or 3.5 miles east of the Terminal (Figure 1-2), is also considered part of the Action Area.

FIGURE 1-1 VICINITY MAP OF THE PROJECT LOCATION NEAR HAINES, ALASKA

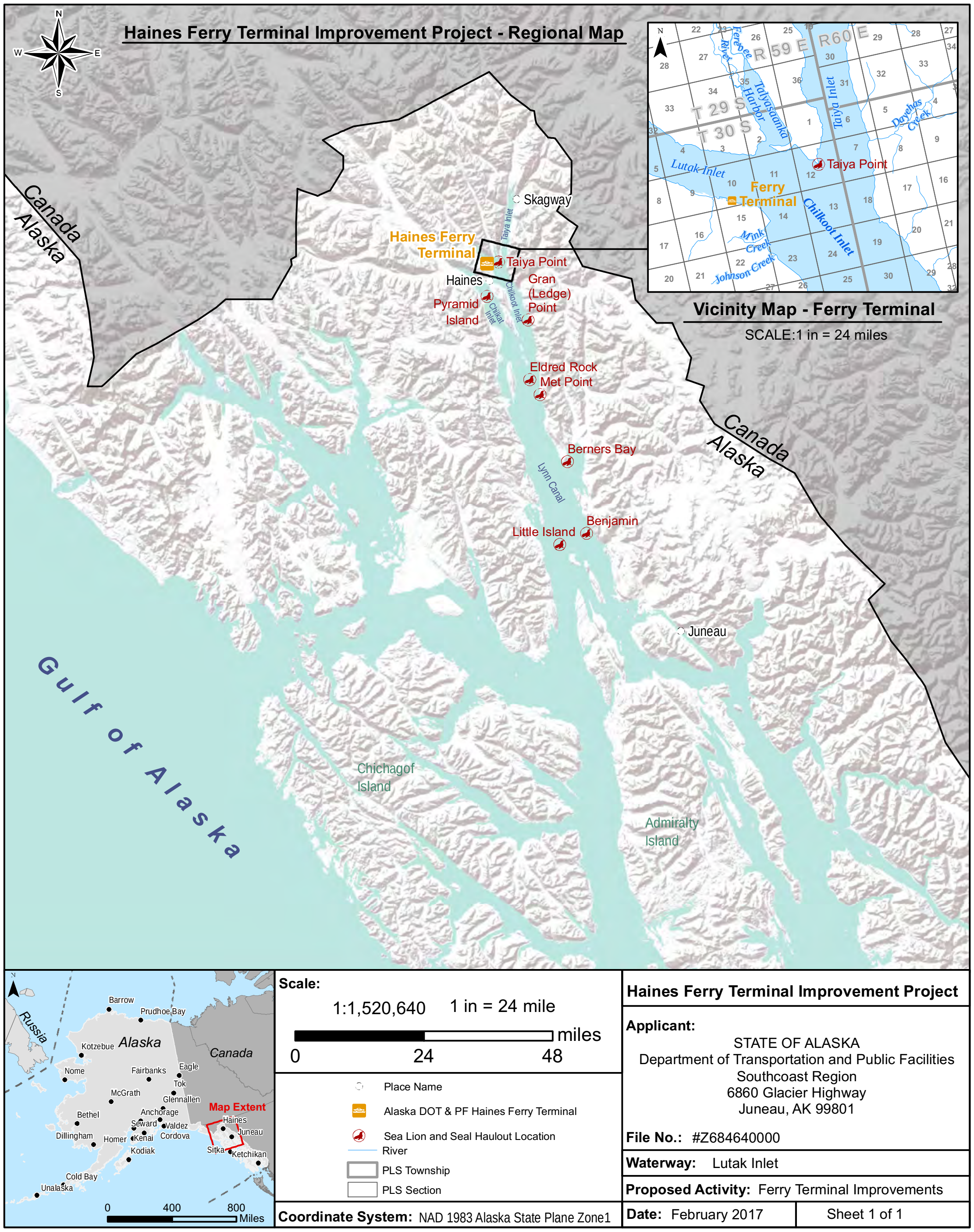
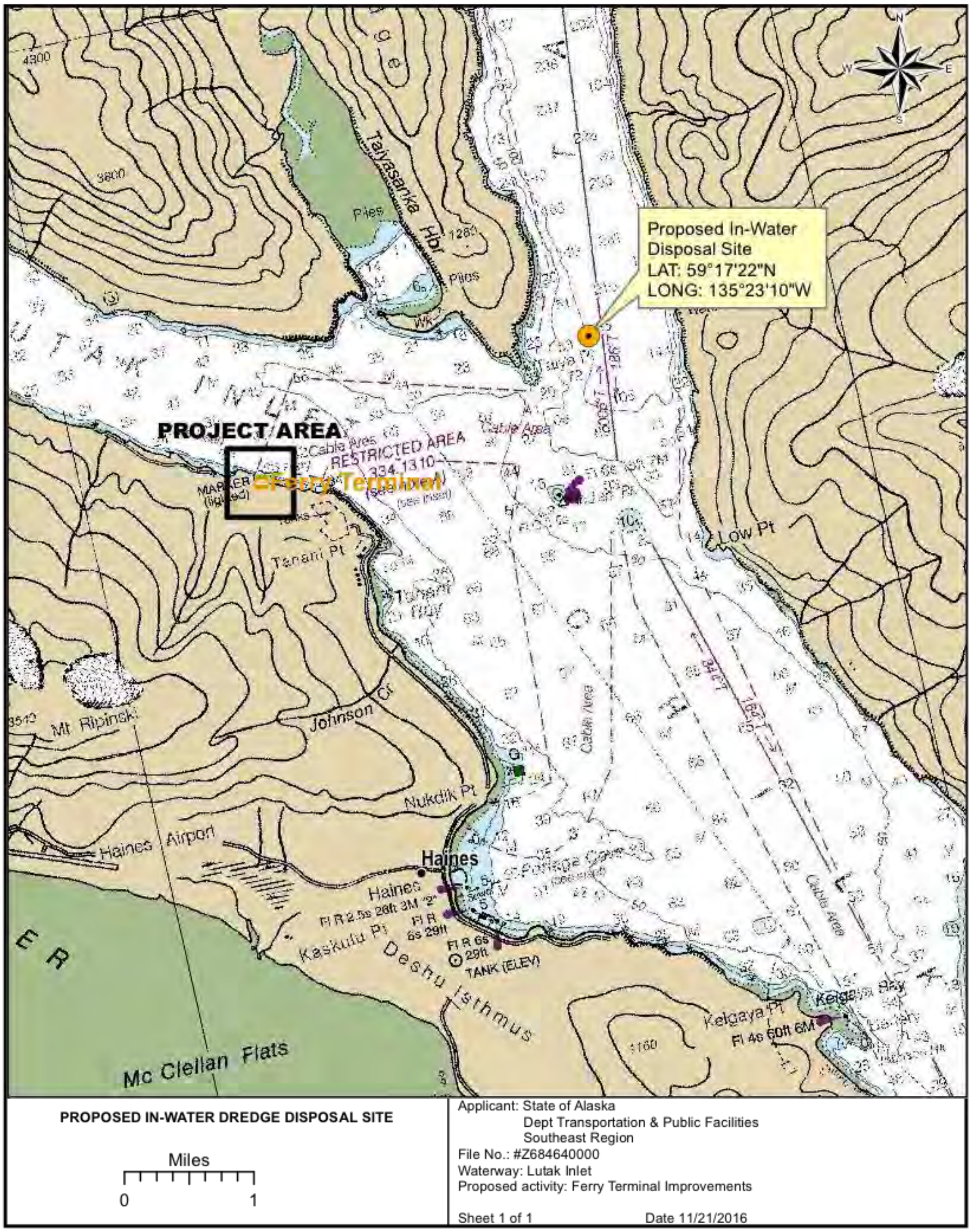


FIGURE 1-2 HAINES FERRY TERMINAL PROJECT AND DREDGE DISPOSAL SITE LOCATIONS



1.2.2. Purpose and Need

In 2014, Alaska DOT&PF initiated construction of two Alaska Class Ferries. The reconfiguration of the Terminal at Haines is necessary because the current configuration does not allow for operation of the new Alaska Class vessels, which are expected to be operational in 2018. The purpose of this project is to modify the existing Terminal (or Lutak Dock) to accommodate end loading of AMHS ferry vessels, speeding the boarding and exiting process once the new Alaska Class Ferries begin service.

1.3. Project Elements that May Result in the Incidental Take of Marine Mammals

1.3.1. Dredging

Much of the dredging for this project was completed in 2015. However, if it is determined additional dredging is required, a barge and clamshell bucket would be used. Any dredging would be completed within a 30-day period. The sediments that may be dredged for this Project were sampled and tested for contaminants in 2009 (Alaska DOT&PF 2015). The Alaska Department of Environmental Conservation found the samples to be in accordance with Alaska Water Quality Standards and issued a Certificate of Reasonable Assurance pursuant to Section 401 of the Clean Water Act for the dredging and sediment disposal for this project.

In 2015, dredged materials were disposed over about seven hectares (18 acres) of seafloor in Taiya Inlet at a water depth of approximately 285 meters (m) (930 ft.) as shown in Figure 1-2, (Alaska DOT&PF 2015). Any dredged materials from this study would be disposed of in a similar manner and location. Dredge disposal requires the use of a barge and tug to transport the material from the dredge site to the disposal site.

Sound generated during use of a clamshell dredge has been recorded at 124 decibels (dB) peak at the 150-m (492-ft) isopleth (Dickerson *et al.* 2001). As a precautionary measure a 200-m (656-ft), shutdown zone would be in effect for MMPA-protected and ESA-listed species for potential acoustic disturbance caused by clamshell dredging. Therefore, while this activity may exceed marine mammal acoustic thresholds at its source, we do not expect it to rise above background noise at the Terminal (area of dredging) and as a result, there should be no direct or indirect effects to marine mammals within the Action Area due to dredging activities. Therefore, acoustic impacts from clamshell dredging are not considered further in this document, and no incidental takes are requested for the dredging activity. Potential impacts to water quality are discussed in Section 9 Impacts to Habitat.

1.3.2. Demolition of Existing Piles and Installation of New Infrastructure

Two elements of the proposed Project would generate noise that may impact marine mammals: vibratory pile removal and driving (Figure 1-3) and impact pile driving (Figure 1-4). Each of these elements generates in-water and in-air noise. Vibratory pile driving is considered to be a continuous or non-pulsed sound type while impact pile driving is considered to be an impulse or pulsed sound type. The distinction between these two sound types is important because they have different potentials to cause physical effects, particularly with regard to hearing (Southall *et al.* 2007).

Source: WSDOT 2016

FIGURE 1-3 VIBRATORY HAMMER

Source: WSDOT 2016

FIGURE 1-4 IMPACT HAMMER

Pulsed sound sources (e.g., impact pile driving) produce signals that are brief (typically considered to be less than one second) and occur either as isolated events or repeated in some succession. Pulsed sounds are all characterized by a relatively rapid rise from ambient pressure to a maximal pressure value followed by a rapid decay period that may include a period of diminishing, oscillating maximal and minimal pressures, and generally have an increased capacity to induce physical injury as compared with sounds that lack these features.

Non-pulsed sounds may be either continuous or non-continuous. Some of these non-pulsed sounds can be transient signals of short duration, but without the essential properties of pulses (e.g., rapid rise time). Examples of non-pulsed sounds in the Action Area include those produced by vessels, dredging and vibratory pile driving. The duration of such sounds, as received at a distance, can be greatly extended in a highly reverberant environment.

The proposed dolphin moorings[5] and berthing structures would be supported on steel piles. In total for the Project, four 30-in. piles would be removed with a vibratory hammer, twenty-two, 30-in. piles and sixteen, 36-in. piles would be installed with a vibratory and/or impact hammer. The 30-in. and 36-in. piles would not likely be installed on the same day. Only one pile driver would be used onsite and it would be necessary to change rigging between different pile sizes.

Alaska DOT&PF anticipates a production rate of two piles to be driven per day, which takes into account setting the piles in place, positioning the barge while working around existing dock and vessel traffic, splicing pile sections, and driving the piles. Installation of the piles would not likely occur over consecutive days as the spacing of the dolphins and float restraint structures would require relocation of pile driving equipment; this could take a day for set up between locations. Based on the pile driving records provided from the previous project at Haines, the contractor first vibrated the pile and then switched to an impact hammer. The switch over to the impact hammer is noted in the pile driving records and was typically done on the same day. Therefore, sound modeling and estimation of incidental takes (Section 6) are based on this assumed production rate of two piles driven per day.

To minimize noise propagation, the steel piles would be driven with a vibratory hammer, as practicable, except for final proofing, which would require use of an impact hammer. In the event that the vibratory hammer is not able to advance the pile, an impact hammer with built-in sound attenuation cushions (pile cushions) would be used as a noise-dampening mitigation. Pile cushions or caps have been found to reduce sound levels by 7 to 8 dB (Laughlin 2006, 2010).

To further minimize disturbance and harm to listed and protected species from pile-driving noise, Alaska DOT&PF would implement a “soft-start” procedure and other mitigating procedures (see Section 11).

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[5] A dolphin mooring is a man-made marine structure that extends above the water level and is not connected to shore. Dolphins are usually installed to provide a fixed structure when it would be impractical to extend the shore to provide a dry access facility, for example, when ships (or the number of ships expected) are greater than the length of the berth/pier. Typical uses include extending a berth (a berthing dolphin) or providing a point to moor to (a mooring dolphin). Mooring dolphins can also be used to "cushion" ship impacts, somewhat similar to fenders. The structures typically consist of several piles driven into the seabed and connected above the water level to provide a platform or fixing point.

1.3.2.1. Vibratory Hammer

Vibratory hammers are commonly used in steel pile driving where sediments allow. They involve the same vibratory hammer used in pile removal. Generally, the pile is placed into position using a choker and crane, and then vibrated between 1,200 and 2,400 vibrations per minute. The vibrations liquefy the sediment surrounding the pile allowing it to penetrate to the required seating depth, or to be removed.

1.3.2.2. Impact Hammer

Impact hammers are used to install plastic/steel core, wood, concrete, or steel piles. An impact hammer is a steel device that works like a piston. Impact hammers are usually large; however, small impact hammers are used to install small diameter plastic/steel core piles. Impact hammers have guides (leads) that hold the hammer in alignment with the pile while a heavy piston moves up and down, striking the top of the pile, and driving it into the substrate from the downward force of the hammer. The pile is first moved into position and set in the proper location using a choker cable or vibratory hammer. Once the pile is set in place, pile installation with an impact hammer can take less than 15 minutes under good substrate conditions, to over an hour under poor conditions, such as glacial till and bedrock, or exceptionally loose material that allow the pile to repeatedly move out of position). Figure 1-4 shows a pile being driven with an impact hammer.

2. DATES, DURATION, AND SPECIFIED GEOGRAPHIC REGION

2.1. Dates and Durations of Activities

ADOT&PF requests and IHA for incidental take of marine mammals described in this application, effective no later than April 1, 2018. The duration of the pile driving would be from approximately mid- to end of June through September 2018. Specifically;

- The daily construction window for pile removal and driving would begin no sooner than 30 minutes after sunrise to allow for initial marine mammal monitoring, and would end 30 minutes prior to sunset to allow for post-pile removal and marine mammal monitoring.
- Demolishing and removing an existing 30-in. diameter, four-pile structure would take 2 days by vibratory methods.
- Vibratory and impact driving of each 30-in. diameter steel pile would take approximately 60-90 minutes; two piles would be installed per day, with 22 piles installed over 11 days. Note the impact driving of 30-in. diameter piles may occur during the same 11-day period as vibratory driving of 30-in. diameter piles.
- Vibratory and impact driving of each 36-in. diameter steel pile would take approximately 60-90 minutes; two piles would be installed per day, with 15 piles installed over eight days. Note the impact driving of 36-in. diameter piles may occur during the same eight-day period as vibratory driving of 36-in. diameter piles.
- Therefore the total number of days required for vibratory pile driving would be 21 days: two for pile removal, 11 for 30-in diameter piles, and eight for 36-in diameter piles. The total number of days required for pile driving of 36-in diameter piles would be eight days.

These estimated times are based on a 24-hr period and are considered to be conservative; the actual hours of vibratory and impact driving would be less.

Vibratory and impact pile driving of 30 in. diameter steel cylindrical piles was conducted at the Haines Ferry Terminal in 2015. Pile-driving records showed minimal pile penetration was achieved using the vibratory hammer and, on average, 700 strikes from the impact hammer were required to reach refusal. Since the sub-bottom properties are expected to be similar for the upcoming Terminal construction, we assume each pile would require one hour of vibratory driving (to account for proper placement and alignment of the pile) and 700 strikes of the impact hammer. Based on recent similar installation projects, it is likely that two piles would be removed and/or installed per day. Therefore, for the purposes of estimating Level A takes the two-pile per day scenario described above was used.

2.2. Geographical Setting

2.2.1. Physical Environment

The northern part of Lynn Canal braids into several inlets including Chilkat, Chilkoot, Lutak and Taiya inlets, which lead into Skagway, Alaska (see Figure 1-1). The Project area is situated in Lutak Inlet on the shores between the Chilkoot and Chilkat rivers. Lutak Inlet is a glacial scoured fiord, characterized by a typical U shaped glacial valley. In many areas ridges are down to bare rock. The bedrock is covered in a thick layer of colluvium. The sediment is homogeneous, consisting of dark gray, silty gravel material, as well as cobbles and boulders (ADOT&PF, 2005). Offshore the water depths reach over 91 m (300 ft.).

2.2.2. Acoustical Environment

The acoustic environment in the Action Area is likely to be dominated by ambient noise from day-to-day ferry terminal, port, and vessel activities. While there are no current measurements of ambient noise levels at the Terminal, it is expected ambient underwater noise levels in the immediate area would be variable and intermittently high. The Terminal is a multi-use dock and is the second busiest AMHS port of call. The facility can support up to four ferry arrivals and departures during any given day in summer.

3. SPECIES AND ABUNDANCE OF MARINE MAMMALS IN THE ACTION AREA

Six marine mammal species or distinct population segments (DPSs[6]) under NMFS jurisdiction are known to occur in the Upper Lynn Canal and Lutak Inlet (Table 3-1). Five of these species may be observed in waters adjacent to the Terminal, on at least a seasonal basis (Dahlheim *et al.* 2009; Allen and Angliss 2013, 2014, 2015; Federal Register 2016a, 2016b) Muto *et al*. 2016; NMFS 1995, 2008, 2013; Womble 2003; Womble *et al*. 2005; Womble and Sigler 2006; J. Womble, National Park Service, pers. comm.; K. Hastings, Alaska Department of Fish and Game, pers. comm. and unpublished data provided to this report, and MOS 2016):

- Harbor seals (*Phoca vitulina*) commonly occur in Chilkat Inlet where there is a small haulout at Pyramid Island, and in Lutak Inlet. They are especially abundant in the Chilkat and Chilkoot Rivers during seasonal late-fall and winter spawning runs of salmon (*Onchorhynchus spp.)* and spring runs of eulachon (*Thaleichtys pacificus*).
- Steller sea lions (*Eumetopias jubatus*) have been observed in the Chilkoot Inlet portion of Upper Lynn Canal on a year-round basis, and they seasonally occupy Lutak Inlet and the immediate Action Area (Figure 1-2). Steller sea lions follow eulachon into Lutak Inlet up to the mouth of the Chilkoot River on spring foraging runs.
- Humpback whales (*Megaptera novaeangliae*) seasonally occur in Chilkoot Inlet, Upper Lynn Canal, and have been observed infrequently near the mouth of Lutak Inlet during the spring eulachon and herring runs. They are generally present in Upper Lynn Canal during mid- to late-spring and vacate the area by July to follow larger aggregations of forage fish in lower Lynn Canal. However, in the past few years a small group has remained in the Project area until fall (MOS 2016).
- Killer whales (*Orca orcinus*) are sporadically and seasonally attracted to the inlet during the large spring aggregations of fish and pinnipeds.
- Harbor porpoise (*Phocoena phocoena*) are observed in waters of the Action Area, and have been infrequently observed in small numbers near the Terminal.
- Dall's porpoise (*Phocoenoides dalli*) have been observed infrequently outside Taiya Inlet, in the deeper waters of Upper Lynn Canal (MOS 2016). However, they may occur within the Action Area due to the extended exposure threshold zones.

Three additional species of Cetacea, the Pacific white-sided dolphin (*Lagenorhynchus obliquidens*), eastern stock of gray whale (*Eschrichtius robustus*), and the minke whale (*Balaenopera acutorostrata*) have been infrequently observed by NMFS during aerial surveys in Lynn Canal. Gray whale sightings in this northern portion of Southeast Alaska are very rare; there have only been eight sightings since 1997 (reported in MOS 2016). These observations were made in the lower portions of Lynn Canal and were not

[6] A DPS or "distinct population segment" is the smallest division of a taxonomic species permitted to be protected under the ESA recognized as a taxonomic species or subspecies of plant or animal, or in the case of vertebrate species (61 FR 4722: February 7, 1996).

close to the Lutak Inlet/upper Lynn Canal area. The range of Pacific white-sided dolphin is also suggested to overlap with Lynn Canal (Angliss and Allen 2015), but no sightings have been documented in the Project area (Dahlheim *et al.* 2009, and as reported in MOS 2016). Only one minke whale has been observed in Taiya inlet over the past five years (MOS 2016). Due to the low probability of these species occurring in the Action Area, exposure of these cetaceans to Project impacts is considered unlikely and take is not requested for these species.

In addition to the available survey data, abundance estimates of all marine mammal species, and seasonal trends and occurrences in the Action Area, have been determined by using best available data for this specific area, including, but not limited to:

- Over a decade of research on seasonal foraging behavior of Steller sea lions from Gran Point haulout, and in the immediate Project Area (J. Womble, pers. comm.; K. Hastings, Alaska Department of Fish and Game [ADF&G], pers. comm.);
- More than a decade of seasonal surveys and abundance estimates of Steller sea lions at the Gran Point haulout location (K. Hastings, ADF&G pers. comm.) documenting a seasonal increase of pinnipeds in the immediate vicinity from approximately 1,000 animals in 2001 to nearly 2,000 in 2015. Average monthly densities for Steller sea lions were estimated using this database (see Section 4.2.1.4);
- Multiple years of marine mammal observations from the ferry service documenting seasonal fluctuations of humpback whales in the area. These data provide seasonal context of occurrence, but not for abundance or density estimates. Estimates of humpback whale abundance used in density calculations was obtained from observation data reported in MOS (2016; see Section 4.3.3);
- Multiple years of whale-watching and opportunistic sighting data from charter vessel observations resulting in trend and abundance data for all marine mammal species in the vicinity of the Haines ferry terminal. These data were used primarily for anecdotal and qualitative descriptions of occurrence, and;
- Site-specific data from MMOs on the previous Haines ferry project[7].
- Numbers, when available, were used from available literature, and personal communication with ADF&G and National Park Service (NPS) personnel, and researchers in the Project region. Personal communication resulted in the best information throughout the year on the occurrence and numbers of marine mammals in Action Area. These data supplemented what could be found in previous reports or data and information made available through reports on activities in the immediate area;
- Recent information was compiled for the Incidental Take Application for the Skagway Gateway Initiative Project and reported in MOS (2016) including a multi-year marine mammal survey. Skagway is located at the head of Taiya Inlet, adjacent to Lutak Inlet, and the project components were similar to the Haines Ferry Terminal Improvements. Where relevant, marine mammal sighting information used in MOS (2016) were incorporated into this application. Although no cetaceans were reported in Taiya Inlet during MOS (2016) multi-year survey, consistent and frequent sightings of humpback whales and harbor porpoises were documented outside the inlet

[7] Only two sightings of marine mammals were reported from the previous project, one of which was a “pod” of porpoise.

in Lynn Canal as far north as Haines. Frequent sightings in Lynn Canal occurred during all three survey periods of the MOS (2016) study. This information was used to estimate potential occurrence in the Action Area of the Haines Terminal Project;

- Killer whales were reported in the Action Area and observations of this species were noted in Lynn Canal during all seasons (K. Hastings, pers. comm.). Killer whales reported near the Haines Terminal likely represent the same individuals sporadically observed each spring/summer season outside the mouth of Taiya Inlet (MOS 2016). Therefore, data from MOS (2016) were used to estimate densities of killer whales in the Action Area for the Haines Terminal Project;
- The NMFS National Marine Mammal Laboratory (NMML), maintains a multi-year database of Steller sea lion counts (Fritz *et al.* 2015) and harbor seals (Peter Boveng, NMFS, NMML, pers. comm.). These databases contain annual survey counts for Steller sea lions and harbor seals; counts of sea lion pups, juveniles and adults; and the movements of branded animals. Several long-term Steller sea lion haulout areas are located in Lynn Canal between Haines and Juneau, and counts show seasonal preferences. The harbor seal data from these surveys were used to estimate seasonal occurrence and densities for this Project.

Abundance estimates for the six marine mammal species that may be encountered in the Action Area are found in Table 3-1. It should be noted these abundance estimates are presented at the stock, DPS or population level, and may exceed the numbers of animals found in Upper Lynn Canal, and especially the Project site, at any time of the year. Where possible, seasonal abundance in waters affected by activities at the Project site are presented in the following sections.

This IHA application is requesting incidental take for potential underwater acoustic disturbance from pile installation activities for harbor seals, Steller sea lions (eastern and western DPS), humpback whales (Hawaii and Mexico DPS), killer whales, harbor porpoises, and Dall’s porpoises (Table 3-1). Additional information on the status and distribution of the affected species is provided in Section 4.

TABLE 3-1 MARINE MAMMAL SPECIES POTENTIALLY PRESENT IN THE ACTION AREA

Common Name	Scientific Name	Stock Abundance Estimate[1]	ESA Status	MMPA Status	Frequency of Occurrence in Project area[2]
Harbor seal	*Phoca vitulina*	9,478	Not listed	Not Strategic, Non-depleted	Likely
Steller sea lion	*Eumetopias jubatus*	49,497 (western DPS) 60,131 (eastern DPS)	Western DPS-Endangered Eastern DPS-Not listed	Endangered, Strategic, Depleted	Rare Likely
Harbor porpoise	*Phocoena phocoena*	11,146	Not listed	Strategic, Non-depleted	Infrequent
Humpback whale	*Megaptera novaeangliae*	10,252 (Hawaii DPS) 3,264 (Mexico DPS)[3]	Hawaii DPS - Not Listed Mexico DPS - Threatened	Not Strategic, Non-depleted Strategic, Depleted	Likely Rare
Killer whale	*Orcinus orca*	2,347 (Alaska residents) 261 (Northern residents) 587 (Gulf, Aleutian, Bering transients) 243 (West Coast transients)	Not listed	Strategic, Non-depleted	Infrequent (all stocks)
Dall's Porpoise	*Phocoenoides dalli*	unknown	Not listed	Non-depleted	Rare

[1] NMFS marine mammal stock assessment reports at Angliss and Allen (2014, 2015), Muto *et al.* (2016) and http://www.nmfs.noaa.gov/pr/sars/species.htm.
[2] Rare: Few confirmed sightings, or the distribution of the species is near enough to the area that the species could occur there; Infrequent: Confirmed, but irregular sightings; Likely: Confirmed and regular sightings of the species in the area at least seasonally.
[3] At Federal Register 81 FR 62259, September 8, 2016

4. AFFECTED SPECIES STATUS AND DISTRIBUTION

4.1. Harbor Seal

4.1.1. Distribution and Status

Harbor seals inhabit coastal and estuarine waters off Alaska. They haul out on rocks, reefs, beaches, and drifting glacial ice, and feed in marine, estuarine, and occasionally fresh waters (Allen and Angliss 2014, 2015). They are considered non-migratory with local movements attributed to factors such as prey availability, weather, and reproduction. In 2010, NMFS identified 12 stocks of harbor seals in Alaska (based on genetic structure, Allen and Angliss 2012).

Harbor seals occurring in the Project area belong to the Lynn Canal/Stephens Passage (LC/SP) stock (Angliss and Allen 2015). The LC/SP stock is genetically distinct and believed to be year-round residents, so estimates of abundance are considered reliable for this species. It is possible to calculate animal densities within this geographical area, as needed. The current abundance estimate for the LC/SP stock is 9,478 (Allen and Angliss 2014), based on aerial survey data (see Table 3-1). The minimum population estimate is 8,605. However, over the past five years the numbers of harbor seals within the LC/SP stock have decreased by 176 seals per year (Muto *et al.* 2015). The latest stock assessment analysis indicates there is a 71 percent probability the stock has declined by 1.8 percent during the period (Muto *et al.* 2015). Possible reasons for the slight decline have not been reported (Muto *et al.* 2016).

Harbor seals are not considered depleted under the MMPA, and they are not listed under the ESA. The LC/SP stock of harbor seals is not classified as a strategic stock (Muto and Angliss 2016).

4.1.2. Presence in Action Area

Harbor seals feed on fish and invertebrates and are opportunistic feeders; they often adjust their distribution to take advantage of locally and seasonally abundant prey. Therefore, the seasonal fish runs of eulachon and salmon in Lutak Inlet and the Chilkat River are a very important forage resource for harbor seals. From mid-March through mid-May during these pre-spawning and spawning aggregations of eulachon and herring, harbor seals are most abundant immediately adjacent to the Terminal. The seals tend to gather in the lower portion of the Chilkoot River, and an estimated 100 individual animals have been observed actively feeding in Lutak Inlet near the mouth of the Chilkoot River, as well as at locations up river during these fish runs, (K. Hastings and J. Womble, pers. comm.). Prior to and after the spawning run, fewer harbor seals are present in these waters, but they may remain further south in the Chilkat River area to forage on late-season salmon runs (late October though winter). During these late season runs, local observations have noted very few, if any, harbor seals are present in waters immediately adjacent to the Haines Ferry Terminal during the winter. Due to its location, activities at the Terminal would not affect haulout behavior or the late-season foraging in Chilkat River (see Figure 1-2).

4.1.3. Acoustics

According to Kastak and Schusterman (1995), harbor seals respond to underwater sounds below 180 kHz. Their functional high frequency limit is about 60 kHz and peak sensitivity is around 32 kHz. Harbor seals have reduced hearing ability for in air sounds, as they respond to sounds from 1-22 kHz with a peak sensitivity of 11-12 kHz (Schusterman 1975).

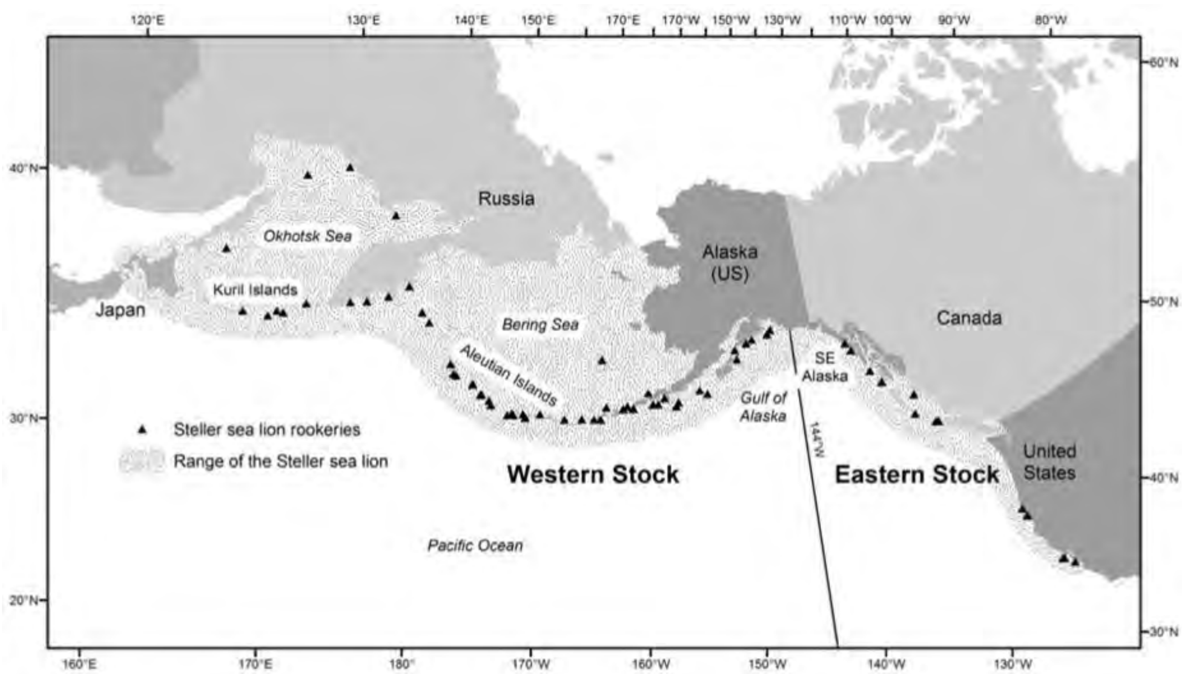
4.2. Steller Sea Lion

4.2.1. Distribution and Status

Steller sea lions range along the North Pacific Rim from northern Japan to California, with centers of abundance and distribution in the Gulf of Alaska and Aleutian Islands. Large numbers of individuals disperse widely outside of the breeding season (late May to early July), thus potentially intermixing with animals from other areas, probably to access seasonally important prey resources (Allen and Angliss 2014). Steller sea lions have been studied throughout their range for the past several decades (NMFS 1995, 2008, 2013).

In 1997, based on demographic and genetic dissimilarities, NMFS identified two Distinct Population Segments (DPSs) of Steller sea lions under the ESA: a western DPS and an eastern DPS (May 5, 1997, 62 FR 24345) (50 CFR 226.202 a and b). Most of the Steller sea lions are part of the eastern DPS (Jemison *et al.* 2013). However, in recent years there has been an increasing trend of the western DPS animals occurring and breeding in Southeast Alaska (NMFS 2013; Fritz *et al*. 2015). Figure 4-1 depicts the geographical delineation of these two DPSs.

FIGURE 4-1 STELLER SEA LION RANGE AND ROOKERY LOCATIONS WITH DESIGNATION BETWEEN THE WESTERN AND EASTERN DPS (NMFS 2008)



4.2.1.1. Western DPS

The current minimum population of western DPS sea lions in Alaska is estimated at 49,497 based on 2014 survey results (DeMaster 2014; Fritz *et al.* 2015; Muto *et al.* 2016). For this estimate, pups were counted during the breeding season, and the numbers of births were estimated from the pup count.

Because of uncertainties regarding the use of pup data, this estimate is also considered the minimum population estimate.

During the 1980s, counts of the western DPS declined approximately 15 percent per year (NMFS 2008), which prompted the ‘threatened’ listing under the ESA. Continued declines in the 1990’s resulted in the ‘endangered’ listing in 1997 (NMFS 2008). Survey data in 2002 and subsequent surveys suggest the overall decline stopped between 2000 and 2002 (Sease and Gudmundson 2002). Trend data collected through 2014 suggest there is strong evidence the population has increased between 2000 and 2014; however, there are also strong regional differences across the range in Alaska (Muto *et al.* 2016). Therefore, the western DPS remains as endangered under the ESA, and strategic under the MMPA.

4.2.1.2. Eastern DPS

Steller sea lions occurring in Lynn Canal are dominated by individuals from the eastern DPS. Moderate to high numbers of eastern DPS Steller sea lions are known to seasonally occupy Lutak Inlet, ranging up to the mouth of the Chilkoot River while foraging for eulachon. The current total population estimate for eastern DPS Steller sea lions is estimated at 60,131 based on counts made between 2009 and 2013 (Allen and Angliss 2014). As described above for the western DPS, pups were counted during the breeding season, and the number of births was estimated from the pup count. The minimum eastern stock population estimate is 36,551 (Allen and Angliss 2014). The best available information indicates the eastern stock of Steller sea lion increased at a rate of 4.18 percent per year (90 percent confidence bounds of 3.71 to 4.62 percent per year) between 1979 and 2010 based on an analysis of pup counts in California, Oregon, British Columbia, and Southeast Alaska (Allen and Angliss 2014). The eastern DPS is not listed under the ESA and remains strategic under the MMPA.

4.2.1.3. Overlap between the Western DPS and Eastern DPS

Overlap between the western DPS and eastern DPS of Steller Sea lions occurs, and increasing numbers of individuals from the western DPS have been seen in Southeast Alaska in recent years (NMFS 2013a). The Steller sea lions that inhabit Lynn Canal are considered part of the eastern DPS, but there is some limited interchange between the eastern and western DPSs. The first western DPS Steller sea lion documented in Lynn Canal occurred in 2003 at Benjamin Island in southern Lynn Canal (approximately 97 km or 60 miles south from the Ferry Terminal and 40 km or 25 miles north of Juneau, Alaska). This animal was subsequently re-sighted in 2003 and 2004. Two additional animals have been observed at Benjamin Island in 2005 and 2006. The ADF&G has documented 88 western DPS Steller sea lions in the eastern region, of which 40 percent were female, and nine of these animals gave birth at rookeries in the eastern region. Data suggest five out of these nine females have permanently immigrated to the eastern region.

Branded individuals from the western DPS have also been observed at Gran Point located about 22.5 km (14 miles) southeast of the Project area[8]. Three individual western DPS sea lions have been observed repeatedly at Gran Point from 2003 through 2012 (NMFS 2013a) representing <0.001. A more recent assessment of branded or marked western DPS sea lions on Gran Point indicate that approximately 1.6%

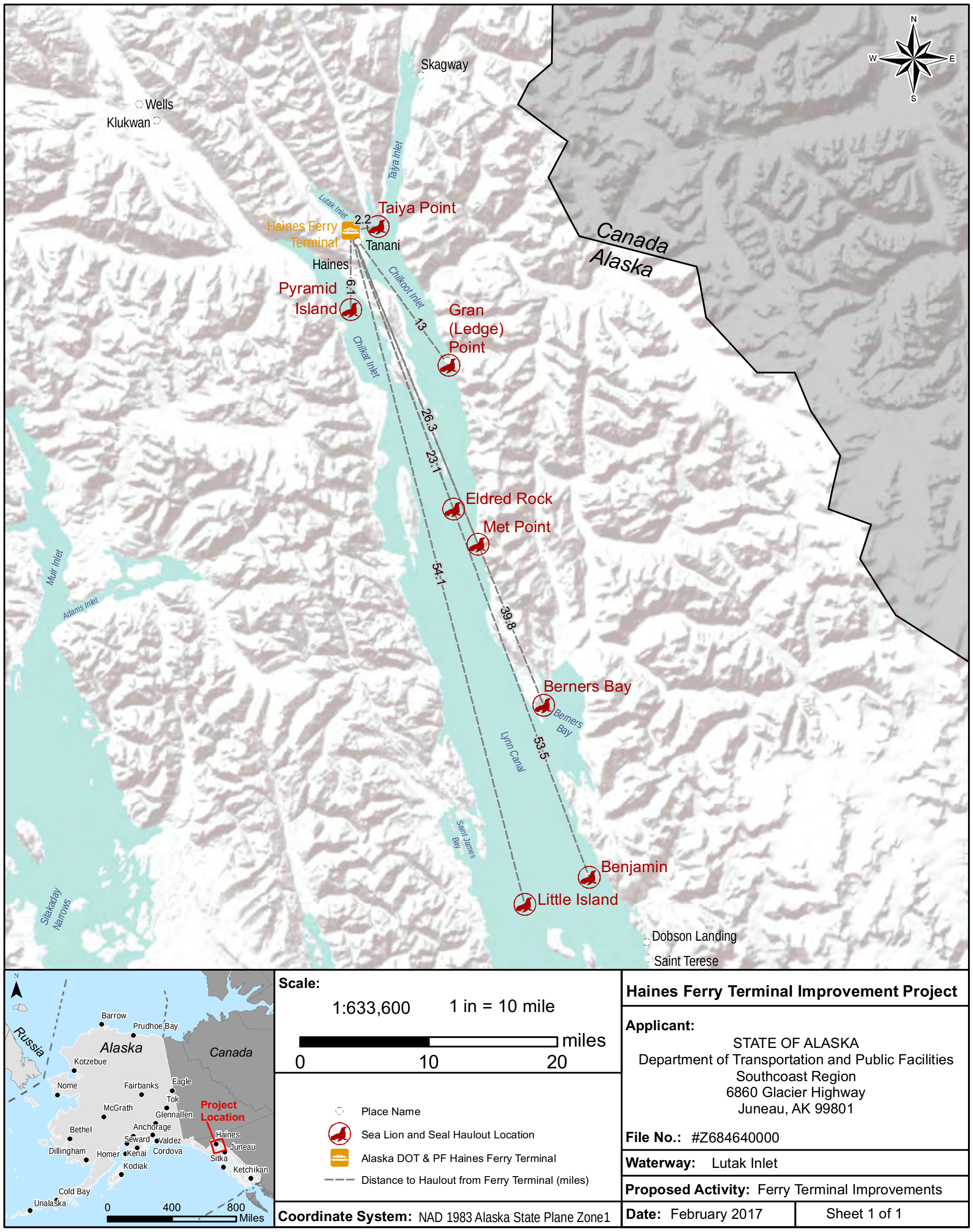
[8]As part of the ESA consultations on the effects of the proposed project, DOT&PF agreed to monitor the use of the Gran Point haulout throughout the year. DOT&PF installed a remote video camera system in late 2002 to determine periods of Steller sea lion use.

percent of the total number of sea lions at Gran Point in May could be from the western DPS (NMFS AKRO, pers. comm.). Gran Point does not serve as a rookery for Steller sea lions. Therefore, we are assuming approximately 2% s (to be conservative) of the sea lions at Gran Point are from the western DPS, and may forage during the spring eulachon runs in the Action Area. Although we cannot make the distinction between western and eastern DPS unless an animal is marked, for purposes of this analysis we assume 2% of the sea lions from the western DPS may be exposed to noise levels that exceed the threshold for Level B harassment each month.

4.2.1.4. Haulouts in Lynn Canal

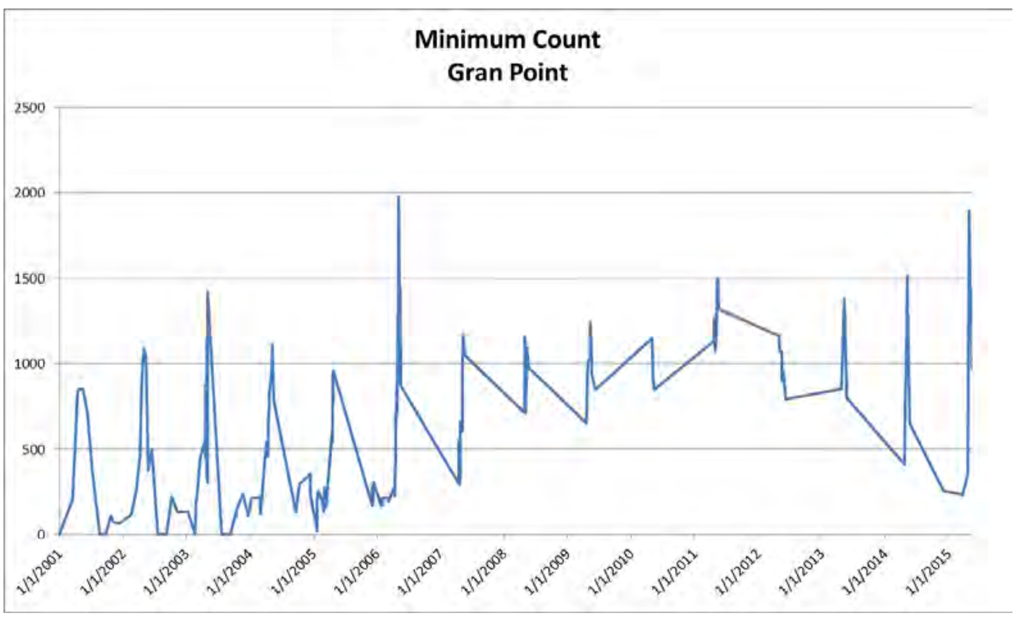
There are several long-term Steller sea lion haulouts in Lynn Canal (see Figures 1-1 and 4-2). The nearest to the Terminal is located at Gran Point in upper Lynn Canal. Other year-round haulouts in Lynn Canal are present at Met Point, Benjamin Island, and Little Island, closer to Juneau (Fritz *et al.* 2015). For about three to four weeks during mid-March through May the eulachon run in Lutak Inlet is extremely important to Steller sea lions for seasonal foraging. During the spring eulachon run, a seasonal haulout site is located on Taiya Point at the southern tip of Taiya Inlet (approximately 5 km or 3.1 miles from Haines Terminal). These spawning aggregations of forage fish provide densely aggregated, high-energy prey for Steller sea lions (and harbor seals) for brief time periods and influence haulout use (Sigler *et al.* 2004; Womble *et al.* 2005; Womble and Sigler 2006) and foraging patterns at Gran Point, Taiya Point and in Lutak Inlet. The pre-spawning aggregations and spawning season for many forage fish species occur between March and May in Southeast Alaska just prior to the breeding season of sea lions (Pitcher *et al.* 2001; Womble and Sigler 2006).

FIGURE 4-2 HAULOUT LOCATIONS



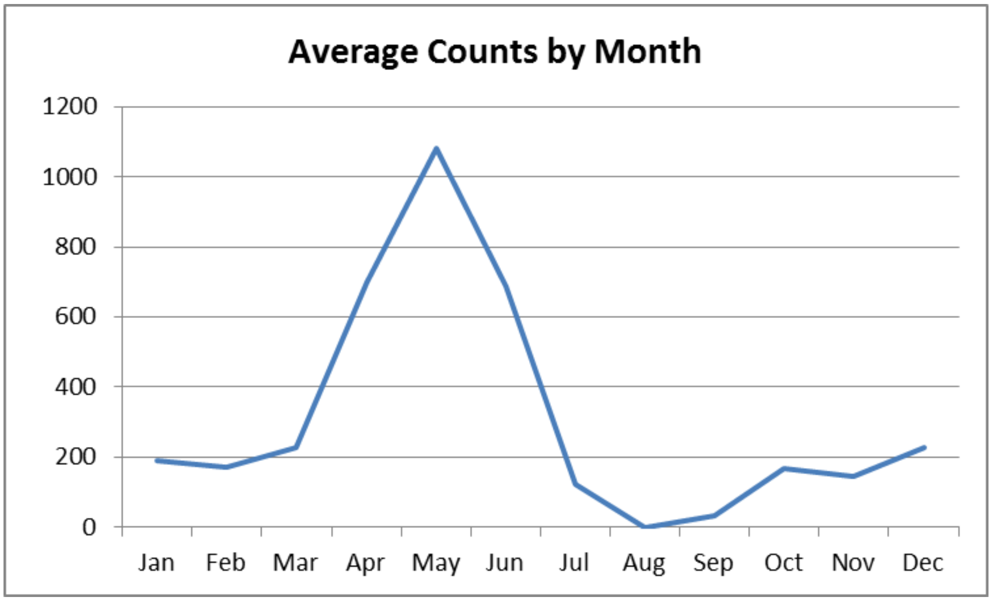
Early data from the video monitoring location at Gran Point, and from aerial surveys conducted since 2002 (unpublished data provided for this application by K. Hastings and J. Womble) were used to estimate the density of sea lions in the Action Area. The data demonstrate the haulout is used most heavily in the spring (mid-April through mid-June, see Figures 4-3 and 4-4, and Table 4-1). However, on average more than a hundred sea lions can be present most months of the year (Figure 4-4, Table 4-1). Generally, the average count decreases significantly from mid-July throughout mid-October and there were periods of time (one to five week blocks in mid-late summer) when sea lions were absent (Table 4-1). In recent years use of the haulout by sea lions has increased by early fall, with more than a hundred animals present at each site by mid-October. There have been generally fewer animals at Gran Point during December through March. At this time, the sea lions generally move further south in Lynn Canal at Berners Bay and/or Benjamin Island and even those present at Gran Point move back and forth to Berners Bay to forage on over-wintering adult herring (Womble and Sigler 2006). However, data collected from 2005 through 2011 indicate an overall increase in numbers at this site and a nearly year-round residency pattern for Steller sea lions at Gran Point (Figures 4-3, 4-4, Table 4-1). In addition, more animals were present from late summer throughout early fall (in recent years) compared to the earlier data (2002 through 2005). Aerial surveys are far fewer after the peak periods of abundance, and video monitoring during winter months was discontinued in 2008, primarily due to the well-established consistent use-pattern of the haulout during winter, and the difficulty in maintaining the system in winter.

FIGURE 4-3 MINIMUM COUNTS OF SEA LIONS AT GRAN POINT HAULOUT 2002-2015



Source: Womble and Hastings unpubl. data)

FIGURE 4-4 AVERAGE MONTHLY COUNTS OF SEA LIONS AT GRAN POINT HAULOUT 2002-2015



Source: Womble and Hastings (unpubl. data)

TABLE 4-1 AVERAGE NUMBER OF STELLER SEA LIONS PER MONTH AT GRAN POINT HAULOUT 2002-2015

Month	Average Count	N	Month	Average count	N
Jan	188.5	10	July	123.7	3
Feb	171.1	9	Aug	0	3
March	228.0	16	Sept	33.0	4
April	697.6	66	Oct	168.5	6
May	1081.0	57	Nov	145.3	3
June	698.4	5	Dec	226.2	12

Source: Womble and Hastings (unpubl. data)

In addition to the Gran Point haulout, Steller sea lions have also been observed to haulout in the spring on small, offshore rocks near Cove Point in Berners Bay (east side of southern Lynn Canal approximately 80 km (50 miles) south of the Ferry Terminal at Haines). There is minimal information on the use of these haulout sites, although juveniles and adults have been observed during the peak of eulachon and herring spawning from mid-March through May. These haulout sites are beyond the Action Area. Because of the configuration of land around the Terminal, noise does not spread to any of the major haulout sites including Gran Point. Therefore, the seasonal, long-term haulouts are considered outside any calculated harassment zone or Zone of Influence (ZOI) from noise sources at the Haines Ferry Terminal.

4.2.1.5. Influence of Prey Species on Distribution of Steller Sea Lions

Prey studies of Steller sea lions have suggested several seasonally available prey species are abundant and densely aggregated during the non-breeding season of Steller sea lions, and sea lions forage on these densely aggregated prey (Sinclair and Zepplin 2002). Steller sea lion foraging efforts in Lynn Canal are consistent with this pattern. In Southeast Alaska, sea lions are seasonally associated with spring-spawning aggregations of eulachon (Marston *et al*. 2002; Sigler *et al.* 2004), and herring (Womble *et al.* 2005). Eulachon contain one of the highest lipid contents of any other sea lion prey (Iverson *et al*. 2002) and play an important role in the seasonal foraging ecology of sea lions in the area (Marston *et al*. 2020; Sigler *et al*. 2004; Womble *et al.* 2005; Womble and Sigler 2006).

Eulachon are anadromous smelt (Osmeridae) spawning primarily in mainland glacial rivers. In southeast Alaska eulachon typically spawn from March to May and attract large numbers of predators (Marston *et al.* 2002; Womble 2003) including Steller sea lions and harbor seals. The Steller sea lion is a major predator of eulachon in southeastern Alaska, especially in Lynn Canal. The exploitation of eulachon by Steller sea lions may be of substantial seasonal significance to the energy budget of sea lions at this time because eulachon are energy-rich (Iverson *et al.* 2001) and their spawning aggregations occur during spring, a period of high-energetic demands for Steller sea lions (Winship *et al*. 2002; Winship and Trites 2003; Sigler *et al*. 2004). Approximately 10 percent of the total number of Steller sea lions in the eastern DPS aggregated at the eulachon and herring spawning sites in Lynn Canal in Spring 2002 (Womble *et al.* 2005). The relationship between sea lions and these ephemeral fish runs is so strong the seasonal abundance and distribution of Steller sea lions throughout Lynn Canal reflects the distribution of spawning herring and pre-spawning/spawning aggregations of eulachon in northern Southeast Alaska, particularly in Lynn Canal (Womble *et al.* 2005).

In winter, large numbers of adult female, dependent young, juveniles and sub-adult Steller sea lions occupy Benjamin Island (southern Lynn Canal) during the non-breeding season from October to April-May (Sigler *et al.* 2004) and forage on overwintering adult herring in the area. Beginning in April Steller sea lion numbers increase at Berners Bay, located approximately 22 km (14 miles) further north of Benjamin Island and approximately 80 km (50 miles) from the Ferry Terminal. In Berners Bay, the period of greatest eulachon abundance, the beginning of the spawning run, and the first observation of Steller sea lions cooperatively foraging all occur with a narrow window of time, only 10-17 days long in early April (Sigler *et al*. 2004).

The largest eulachon run in northern Lynn Canal occurs in Lutak Inlet/Chilkoot River approximately two weeks after the April pre-spawning/spawning peak in Berners Bay. Following the fish, Steller sea lions move north from Berners Bay to Gran Point, and to seasonal, smaller haulouts north of Gran Point. As Gran Point sea lion numbers increase, the location rapidly becomes the largest haulout in Lynn Canal. Eulachon in Lutak Inlet/Chilkoot River are densely aggregated, and high in fat content during pre-spawning/spawning migrations. These dense concentrations of high quality prey in low-velocity shallow waters make them a favorable target for predators such as sea lions and seals (Marston *et al.* 2002).

Other seasonal prey species provide high-energy nutrition at different times of year, and the presence of these species also influences the distribution of sea lions (Womble *et al.* 2005) and harbor seals in Lutak Inlet, and the Chilkat River. Five species of salmon spawn in rivers and nearby streams and tributaries near Haines. The salmon runs begin in the late-summer and continue through late fall or early winter. Salmon increase in importance as prey for sea lions and other predators from late-October and December in the Chilkat River, coinciding with the fall run of spawning pink salmon (*Oncorhynchus gorbuscha*), and late season runs of coho salmon (*O. kisutch*) and chum salmon (*O. keta*) as they return to rivers in northern Lynn Canal to spawn. At this time they become available to sea lions as a source of high-energy prey.

In summary, the seasonal movements of Steller sea lions and harbor seals follow dense aggregations of pre-spawning and spawning prey species throughout Lynn Canal. The largest aggregations of sea lions in winter target herring in the lower portions of the canal, followed by a gradual but predictable movement north during spring (mid-April through mid-June) as they follow dense aggregations of eulachon. In early summer through fall, Steller sea lions disperse southward from the northern portions of Lynn Canal following multiple runs of salmon throughout the canal, prior to the return of adult herring aggregations in late fall through winter.

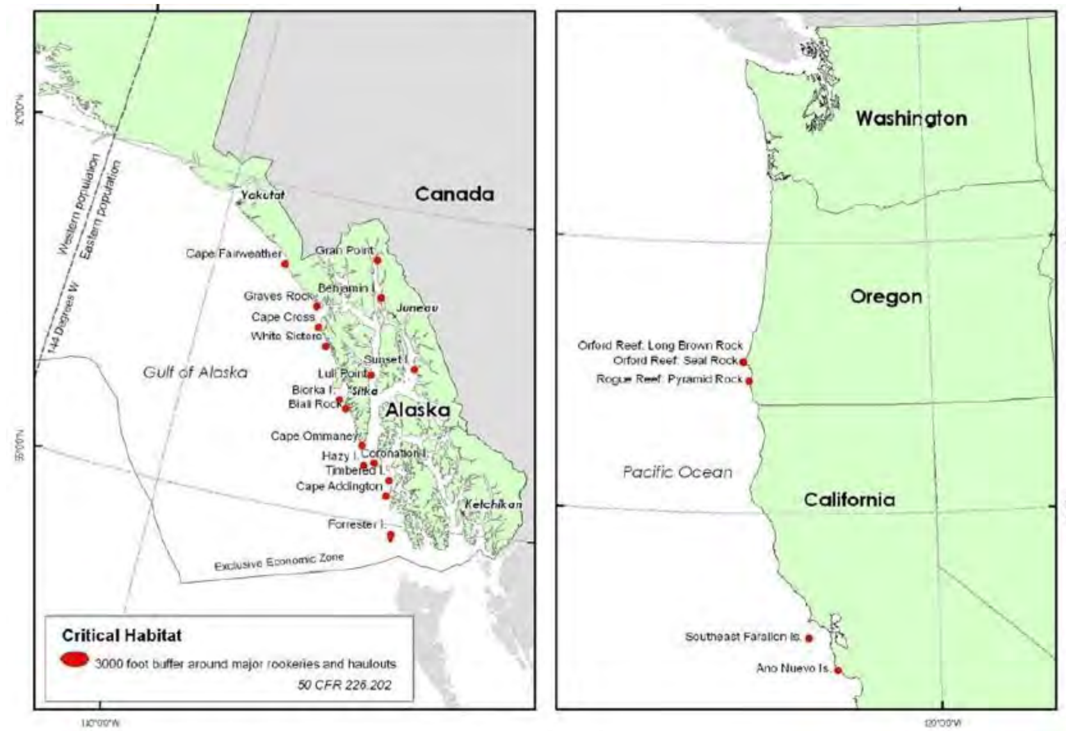
4.2.2. Critical Habitat

NMFS designated critical habitat for Steller sea lions on August 27, 1993[9]. At the time of designation, Steller sea lions were listed as a single species (not two DPSs). Although the eastern DPS is no longer protected under the ESA, it remains protected under the MMPA and the designated critical habitat remains unchanged because it was established for the entire population, before the two DPS units were recognized. Thus, the designation includes sites within the breeding range of both the eastern DPS and the western DPS.

In identifying aquatic habitats as part of critical habitat, NMFS specifically highlighted several components of such habitats: nearshore waters around rookeries and haulouts, traditional rafting sites, food resources, and foraging habitats. Adequate food resources are an essential feature of the Steller sea lion's aquatic habitat (58 FR 45269). NMFS designated critical habitat that includes marine waters within 20 nautical miles of rookeries and haulouts within the breeding range of the western DPS and within three special aquatic foraging areas in Alaska (50 CFR 226.202, a and c, respectively). Critical habitat also includes an aquatic zone that extends 914 m (3,000 feet) seaward from the baseline or basepoint of each major rookery and major haulout in Alaska that is east of 144° W. longitude (the range of the eastern DPS) in state and federally-managed waters. The closest haulout to the Terminal that has been designated as a Steller sea lion critical habitat is Gran Point (50 CFR 226.202; see Figure 4-5). The configuration of land around the Terminal site limits the distance that sound would propagate throughout upper Lynn Canal. Sound from the proposed action is not expected to reach the Gran Point haulout site as it is over 22.5 km (14 miles) to the southeast, and around Chilkat Peninsula from the Terminal (see Figures 1-1 and 4-1).

[9] At *Federal Register* 58 FR 45269.

FIGURE 4-5 STELLER SEA LION CRITICAL HABITAT (NMFS 2013)



4.2.3. Presence in Action Area

Over a decade of research on seasonal foraging behavior of Steller sea lions shows that Steller sea lions move from the Gran Point haulout (Womble *et al.* 2005; Womble and Sigler 2006) into the Action Area, and the immediate Project site during the spring fish runs, resulting in local seasonal increases in abundance (K. Hastings pers. comm.). This is consistent with the seasonal trends at Gran Point observed from data from aerial surveys as described in Section 4.2.1.4. The aerial surveys demonstrate a clear annual cycle, with a peak of abundance at Gran Point during Spring (generally March-May) followed by a steep decline in numbers through the summer into Fall (Figure 4-3). These data were used to calculate monthly density estimates for this species in the Action Area. In addition to the seasonal trends, there has been a consistent, annual increase of pinnipeds at this location from approximately 500 animals in 2002 to over nearly 2,000 in 2015 (Womble *et al.* 2005, K. Hastings, and ADF&G unpubl. aerial survey data). During the late-spring months, the largest numbers of animals have been observed at Gran Point (Fritz *et al.* 2015), and can serve as a good estimate of the maximum number of animals that move back-and-forth from the haulout into the Action Area to forage from March through May. Following the fish runs, the sea lions generally move farther down Lynn Canal although a few may be present year round, and this number seems to be increasing (Figure 4-3). Many of the tagged sea lions at Gran Point begin foraging on adult herring located south of the haulout during winter, even if they are counted at the haulout.

Most animals leave Lutak Inlet shortly after the eulachon run and are rarely observed after about the first week in May. Sea lions are rarely observed in Lutak Inlet during the winter (K. Hastings, ADF&G, pers. comm.), and generally move to, and forage in, the mid- to southern reaches of Lynn Canal when adult herring are returning to overwinter in the area. This is consistent with the NMFS, National Marine

Mammal Laboratory database (Fritz *et al.* 2015), which has confirmed that the largest number sea lions in Lynn Canal during the fall and winter months occurs at Benjamin Island in the lower reaches of Lynn Canal, approximately 32 km (25 miles) north of Juneau.

4.2.4. Acoustics

Hearing capacity for Steller sea lions is thought to be similar to the hearing range of California Sea lions: from 1-80 kHz in water, and less than 30 kHz in air (Nedwell *et al.* 2004). Underwater, hearing sensitivity in Steller sea lions has been measured from 1-16 kHz for a male individual. The maximum hearing sensitivity of a female individual was measured at 25 kHz, showing a marked sexual dimorphism. However, hearing characteristics may also vary based on age or size of the individual (Kastelein *et al*. 2005).

4.3. Humpback Whales

4.3.1. Distribution and Status

Humpback whales are the most commonly observed baleen whale in Lynn Canal and, generally, throughout Southeast Alaska, particularly during the spring and summer foraging months. Humpback whales in Alaska, although not limited to these areas, return to specific feeding locations in southeast Alaska including Lynn Canal (Wing and Krieger 1983). In Lynn Canal they have been observed in the spring and fall from Haines to Juneau.

In the North Pacific, humpback whales migrate from low-latitude breeding and calving grounds to geographically distinct aggregations on higher-latitude feeding grounds. While a very small degree of interchange has been documented, these feeding aggregations are generally isolated from each another.

In 1970, following substantial declines due to commercial whaling, the humpback whale was listed as endangered under the ESA. The humpback whale is also designated as depleted under the MMPA. As a result of the ESA listing, the central North Pacific Stock of humpback whale is also classified as a strategic stock under the MMPA. NMFS conducted a review of the humpback whale DPS designation and ESA listings and drafted a status report[10]. Based on information presented in the status report, NMFS proposed revised the species-wide listing of the humpback whale in 2015[11], and a revision to the status of humpback whale DPSs was finalized by NMFS on September 8, 2016[12], effective October 11, 2016. In the final decision, NMFS recognized the existence of 14 DPSs, classified four of those as endangered and one as threatened, and determined that the remaining nine DPSs do not warrant protection under the ESA. Three DPSs of humpback whales occur in waters off the coast of Alaska: the Western North Pacific (WNP) DPS, which is an endangered species under the ESA, the Mexico DPS, which is a threatened species, and Hawaii DPS, which is not protected under the ESA. Wade *et al.* (2016) determined that humpback whales from the endangered WNP DPS are uncommon in waters off Alaska and are only likely to be encountered in the Aleutian Islands and Bering Sea region. Mexico DPS whales occur in the Gulf of Alaska with a 10.5 percent probability of occurrence. Humpback whales in Southeast Alaska are most

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[10] Status Review available at *http://www.fisheries.noaa.gov/pr/species/mammals/whales/humpback-whale.html*.
[11] At 80 FR 22304, 21 April 2015
[12] At 81 FR 62259, Endangered and Threatened Species; Identification of 14 Distinct Population Segments of the Humpback Whale (*Megaptera novaeangliae*) and Revision of Species-Wide Listing

likely to be from the Hawaii DPS (93.9% probability). Therefore, when a proposed action is expected to take humpback whales off Alaska, the best available information indicates that the total number of anticipated takes should be apportioned to the WNP, Mexico, and Hawaii DPSs using the probabilities of occurrence noted by Wade *et al.* (2016).

Under the MMPA, humpback whales are considered to be depleted species-wide based solely on the species' ESA listing. Therefore, upon the effective date of this rule, humpback whales that are listed as threatened or endangered would retain depleted status under the MMPA and humpback whales that are not listed as threatened or endangered would lose depleted status under the MMPA. NMFS would conduct a review of humpback whale stock delineations in waters under the jurisdiction of the United States to determine whether any stocks should be realigned in light of the ESA DPSs established in the final rule. Until such time as the MMPA stock delineations are reviewed, NMFS would treat existing MMPA stocks that fully or partially coincide with a listed DPS as depleted and stocks that do not fully or partially coincide with a listed DPS as not depleted for management purposes. Therefore, as shown in Table 3-1, the Hawaiian DPS is considered as Not Strategic, Non-depleted under the MMPA, while the Mexico DPS is considered Strategic, Depleted. As noted above humpback whales in southeast Alaska, especially in the extreme northern waters of Lynn Canal, are most likely to be from the Hawaii DPS.

4.3.2. Critical Habitat

Critical habitat has not been designated for the humpback whale.

4.3.3. Presence in Action Area

Humpback whales are generally present during mid- to late spring (mid-May through June) in the Action Area and vacate the area by July to follow large aggregations of forage fish in lower Lynn Canal. However, in recent years humpback whales have been observed at the entrance to Taiya Inlet throughout the fall months (MOS 2016). Four to five whales were observed outside the mouth of Taiya Inlet from spring 2015 to November (MOS 2016) in the Action Area. However, it is atypical for these whales to remain this far north so late in the year. These are likely the same individuals that have been observed at the mouth of Lutak Inlet in recent years (K. Hastings, person. comm.). This is the best, most current information on whale abundance and occurrence in the Action Area and was used to estimate densities in the Action Area through October for take calculations (Section 6). Surveys conducted in Southeast Alaska between 1991 and 2007 found humpback whales throughout the area, with high concentrations occurring in several locations including Lynn Canal (Dahlheim *et al.* 2009). Generally, humpback whales are very numerous in southern Lynn Canal and are observed daily during late-spring through summer by the ferry system. Sightings become less frequent moving north into Upper Lynn Canal. Individual animals have been observed in late-spring at the mouth of Lutak Inlet, sometimes near the Haines Ferry Terminal, especially during the spring eulachon and herring pre-spawning seasons. Following the spring fish aggregations, a few individuals are observed in northern Lynn Canal intermittently throughout the summer months (MOS 2016), but most whales move further south closer to Juneau, or Frederick Sound, and are absent from the Action Area.

4.3.4. Acoustics

Southall *et al*. (2007) categorized humpback whales in the low frequency functional hearing group, with and estimated auditory bandwidth of 7 to 22 kHz.

4.4. Killer Whale

4.4.1. Distribution and Status

Killer whales are found throughout the North Pacific. Along the west coast of North America killer whales occur along the entire Alaskan coast, in British Columbia and Washington inland waterways, and along the outer coasts of Washington, Oregon, and California (Allen and Angliss 2014). Seasonal and year-round occurrence has been noted for killer whales throughout Alaska and in the intra-coastal waterways of British Columbia and Washington State.

Killer whales that are observed in Lynn Canal could belong to one of three different stocks: Eastern North Pacific Northern Residents Stock (Northern residents); Gulf of Alaska, Aleutian Islands, and Bering Sea Transient Stock (Gulf of Alaska transients); or West Coast Transient Stock. The Gulf of Alaska Transient Stock occupies a range that includes southeastern Alaska. Photo-identification studies have identified 587 individual whales in this stock (Table 3-1). A total of 219 transient killer whales from the West Coast Transient Stock have also been identified between Southeast Alaska and British Columbia (Allen and Angliss, 2012). However, more recent analysis of photographic data identified 243 individual transient killer whales in this stock (Allen and Angliss 2012).

From 1991 to 2007, an increasing population trend of 5.2 percent annually has been documented for transient killer whales in Southeast Alaska (Dahlheim *et al*. 2009). While killer whales occurring in Lynn Canal can belong to one of several different stocks, photo- identification studies since 1970 have catalogued most individuals observed in this area as belonging to the Northern Resident Stock. In 2010 the population was composed of three clans representing a total of 261 whales (reported in MOS 2016). Because this population has been studied for such a long time, the estimated population size of 261 animals can serve as a minimum count of the population.

All of the killer whale stocks in Southeast Alaska are protected under the MMPA. However, none of them are designated as depleted under the MMPA or listed as threatened or endangered under the ESA (Allen and Angliss 2014). Therefore, none of the three stocks of killer whales are classified as a strategic stock.

4.4.2. Presence in Action Area

Resident and transient killer whales have been documented in the middle to lower reaches of Lynn Canal (Dahlheim *et al.* 2009), and in upper Lynn Canal and Lutak Inlet (K. Hastings, pers. comm.). Transient killer whales have been found in all major waterways of southeastern Alaska, including Lynn Canal, in open-strait environments, near-shore waters, protected bays and inlets, in ice-laden waters near tidewater glaciers, and around Steller sea lion haulout sites (Dahlheim *et al*. 2009). They feed on other marine mammals including Steller sea lions, harbor seals, and various species of small cetaceans, while resident killer whales typically eat fish, particularly salmon, in this region (Parsons *et al.* 2013), and can be distinguished by a rounded dorsal fin (Parsons *et al.* 2013).

Transient killer whales occur in smaller, less matrilineal groupings than resident killer whales. They are also more likely to rely on stealth tactics when foraging, making fewer and less conspicuous calls, and edging along shorelines and around headlands in order to hunt their prey in highly coordinated attacks (Barrett-Lennard *et al.* 2011). Residents often travel in much larger and closer knit groups within which they share any fish they catch.

Dahlheim *et al.* (2009) found that transient killer whale mean group size ranged from four to six individuals in Southeast Alaska. The occurrence of transient killer whales increases in summer, with lower numbers observed in spring and fall. This is consistent with data from observations in the immediate location of the Haines Ferry Terminal. Data from Lutak Inlet suggests that a small number of killer whales infrequently enter the inlet, generally during spring fish runs when large aggregations of pinnipeds are also present (K. Hastings, pers. comm.). Up to 15 to 20 killer whales have been observed in Taiya Inlet four to five times a year from early spring through fall (MOS 2016). Transient killer whales have also been observed in Lutak Inlet in front of the Terminal when sea lions are present (K. Hastings, pers. comm.), presumably following their preferred food source. The mean group size of four to six animals documented by Dahlheim *et al.* (2009) is consistent with four to five sightings of up to 20 whales outside Taiya (MOS 2016) and Lutak Inlets. This data was used to estimate killer whale densities for take calculations (See Section 6).

4.4.3. Acoustics

Killer whales rely on underwater hearing for a variety of activities including orientation, feeding, and communication. Killer whales have a well-developed sense of hearing and are able to respond to sounds between one and 120 kHz, with the most sensitive range between 18 and 42 kHz (Szymanski *et al.* 1999). 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). Killer whales are part of the mid-frequency cetacean functional hearing group with an estimated auditory bandwidth between 150 and 160 kHz (Southall *et al.* 2007).

4.5. Harbor Porpoise

4.5.1. Distribution and Status

Harbor porpoise are common in coastal waters. In the Gulf of Alaska and Southeast Alaska they are observed most frequently in waters less than 100 m (328 ft.) deep (Dahlheim *et al.* 2009). Within the inland waters of Southeast Alaska, the harbor porpoise distribution appears patchy and clumped. Greatest densities have been observed in the Glacier Bay/Icy Strait region, and near Zarembo and Wrangell Islands and the adjacent waters of Sumner Strait (Allen and Angliss 2014).

There are three harbor porpoise stocks in Alaska: the Bering Sea Stock, the Southeast Alaska Stock, and the Gulf of Alaska Stock (Angliss and Allen 2015). Only the Southeast Alaska stock occurs in the Action Area (Muto et al. 2016). Harbor porpoise numbers for the Southeast Alaska stock are estimated at 11,146 animals (Allen and Angliss 2014). Abundance estimates for harbor porpoise occupying the inland waters of Southeast Alaska were 1,081 in 2012. However, this number may be low due to survey methodology (Allen and Angliss 2014). The mean group size of harbor porpoise in Southeast Alaska is estimated at two individuals (Dahlheim *et al.* 2009). In Lynn Canal, aerial observations were infrequent, and occurred primarily in lower Lynn Canal from Chatham Strait to Juneau.

Harbor porpoise are not designated as depleted under the MMPA or listed as threatened or endangered under the ESA. However, because the abundance estimates are 12 years old and the frequency of incidental mortality in commercial fisheries is not known, the Southeast Alaska Stock of harbor porpoise is classified as a strategic stock under the MMPA (Muto *et al.* 2016).

4.5.2. Presence in Action Area

In Lynn Canal, observations of harbor porpoise are not frequent and occur primarily in lower Lynn Canal near Juneau. This may be simply due to observer bias as more people are on the water closer to Juneau. This species is considered to be more common than is documented from aerial data, and is often observed by people who encounter small groups of two or three animals. Local observations occur throughout the year in Upper Lynn Canal between Haines and the Gran Point haulout site (J. Womble, pers. comm.). The species has been observed as far north as Haines during the summer surveys (Dahlheim *et al.* 2009). Marine mammal observers (MMOs) at the Haines Ferry Terminal observed one small pod of harbor porpoise on September 22, 2015[13]. The species is not abundant in Taiya Inlet, but has been observed in low numbers, consistent with numbers observed in Lutak Inlet. Approximately 30 individuals have been observed in multiple groups of two or three, from spring through fall (MOS 2016). This data is consistent with data from multiple observations of small groups of two to three individuals (two adults and a calf in summer) throughout the Action Area (J. Womble, pers. comm.).

4.5.3. Acoustics

The harbor porpoise has the highest upper-frequency acoustic limit of all odontocetes investigated. Kastelein *et al.* (2002) found that the range of best hearing was from 16 to 140 kHz, with a reduced sensitivity around 64 kHz. Maximum sensitivity (about 33 dB referenced to one micropascal (dB re 1 μPa) occurred between 100 and 140 kHz. This maximum sensitivity range corresponds with the peak frequency of echolocation pulses produced by harbor porpoises (120–130 kHz).

4.6. Dall's Porpoise

4.6.1. Distribution and Status

Dahlheim *et al*. (2009) found Dall's porpoise throughout Southeast Alaska, with concentrations of animals consistently found in Lynn Canal, Stephens Passage, Icy Strait, upper Chatham Strait, Frederick Sound, and Clarence Strait.

There is only one Dall's porpoise stock in Alaska, but there are no reliable abundance data for this stock (Muto *et al.* 2016). Surveys for the Alaska Stock of Dall's porpoise are more than 21 years old (Allen and Angliss 2014). A population estimate determined from observations over then period 1987 to 1991 was 83,400. Since the abundance estimate is based on data older than eight years, the current minimum population number is considered unknown. The mean group size of Dall's porpoise in Southeast Alaska is estimated at three individuals (Dahlheim *et al.* 2009).

[13]Haines Ferry Terminal Improvements, Marine Mammal Observation Form, Sept. 22, 2015.

Dall's porpoise are not designated as depleted under the MMPA or listed as threatened or endangered under the ESA. The Alaska stock of Dall's porpoise is not classified as a strategic stock.

4.6.2. Presence in Action Area

Local observers have observed only three to six Dall's porpoises in Taiya Inlet during the early spring and late fall (MOS 2016). Observations were not predictable, and were occasional to sporadic. No animals have been observed during the summer or winter. This is consistent with Dahlheim *et al.* (2009). Using this limited information for the purposes of this IHA, we estimate that three animals would be present in the Action Area during the fall (between September and October). Since observations during this time period have been occasional, we assume a presence in the inlet as unlikely. Dall's porpoise have not been observed in the waters of Lutak Inlet immediately adjacent to the Terminal but may be present further out in the Action Area, in northern Lynn Canal.

4.6.3. Acoustics

Dall's porpoise have an estimated functional hearing frequency range between 180 and 200 kHz and are considered high-frequency cetaceans (Southall *et al.* 2007).

5. TYPE OF INCIDENTAL TAKE AUTHORIZATION REQUESTED

The construction and reconfiguration of the Terminal has the potential to take by Level A or Level B[14] acoustical harassment up to six species of marine mammals.

Construction activities are not expected to result in serious injury or mortality of any marine mammal, and are planned to be completed within a 12-month period of time. Therefore, Alaska DOT&PF is applying for an IHA, pursuant to Section 101(a)(5)(D) of the MMPA, 16 USC Section 1371.101 (a)(5), and 50 CFR Section 216, Subpart I, effective approximately April 2018, for incidental take of up to six species of marine mammals.

5.1. Method of Incidental Taking

The actions outlined in Section 2 have the potential to take marine mammals by exposure to underwater sound. Level A and Level B harassment takes could potentially result from the following specific aspects of the proposed Project: waterborne noise from impact pile driving and vibratory pile driving. It is anticipated that all of the marine mammals that enter the Action Area may be briefly subjected to Level B take thresholds, and possibly Level A harassment (unless mitigated) from pile-driving noise as they transit the area (i.e., serious injury or mortality is not expected). If any marine mammal is observed to be about to enter the Level A harassment zone, all pile driving would be shut down immediately, until the animal has voluntarily left the Level A harassment zone. Similarly, pile driving would be shut down immediately if any non-permitted marine mammal species is observed about to enter the Level B harassment zone, as take has is only being requested for the six species described in Section 4. Any permitted species observed within the Level B harassment zone would be recorded as a take. The harassment zones as well as the noise levels that are expected to result from the construction of this Project are described in detail in Sections 6.1 through 6.6. Protocols for observation and mitigation methods are discussed in detail in Section 11.

In July 2016, NMFS published revised acoustic Level A injury criteria based on frequency-weighted sound exposure levels. Using these guidelines, the maximum extent of Level A exposure zones (distance and ensonified areas) for each marine mammal functional hearing group, for both impact and vibratory pile driving of 30-in. and 36-in. diameter piles has been calculated. These calculations were used in the estimation of takes by species and month for marine mammals potentially impacted by the proposed Project activities.

Based on the revised NMFS guidelines, Level A thresholds have resulted in an increase in the size of the Level A ensonified areas compared to the approach used under previous NMFS guidance; the new guidance considers cumulative sound exposure over a 24-hour period. Level B thresholds continue to be based on a single hammer strike event. Therefore, it may be necessary to request Level A incidental take in this IHA application for several of the species found within the Project area. This is especially true during impact pile driving of 36-in. diameter piles. For example, if it is assumed that harbor porpoise are present year-round (or most of the year) it is difficult to detect and mitigate an occasional porpoise sighting prior to the animal

[14] Level A harassment may result in injury or death, whereas Level B only results in disturbance without the potential for injury. However, authorization of a Level A harassment take does not automatically imply that serious-injury to an animal has occurred.

being exposed to the Level A noise threshold. In this case, it must be assumed that a Level A take has occurred, albeit at some distance from the sound source.

Authorization of Level A take does not automatically imply that serious-injury to an animal has occurred. Many animals may not necessarily experience sound exposure levels that exceed the injury threshold if the exposure is temporary or of very short duration. If a marine mammal enters the Level A zone during pile driving, and quickly leaves, it is unlikely that the animal experienced significant adverse impact because the exposure would not result in ‘serious injury’. This is a likely scenario for most cetacean species in the area given the potentially large Level A threshold distances.

ADOT&PF is requesting an IHA authorizing incidental take by Level A and Level B acoustical harassment, resulting from impact pile driving (Level A and Level B takes) and active vibratory pile driving activity (Level B takes only) during the planned reconfiguration of the Terminal at Haines, Alaska, beginning approximately April 2018. The requested IHA would allow the non-lethal, potential future taking of small numbers of marine mammals by harassment incidental to the proposed activities that would be conducted during all construction and reconfiguration phases of the Project.

During the spring eulachon and herring runs, pinnipeds forage near the immediate area of the Project despite the vessel traffic to and from the terminal. Because pinnipeds seem habituated to the routine background noise and ship traffic at the Terminal during this important foraging season, harbor seals and Steller sea lions could be exposed multiple times to elevated noise levels during pile driving if the activity occurred mid-April through May. For that reason, Alaska DOT&PF has determined that the proposed construction activities at the Terminal would not occur during this season. Conducting pile-driving operations later in the year would reduce, or eliminate depending on the species, the likelihood of a take by acoustic harassment (see Section 11).

5.2. Compliance with ‘Small Numbers’ and ‘Negligible Impact’ Requirements of MMPA

Section 101(a) (5)(d) of the MMPA allows, upon request, the incidental, but not intentional taking of small numbers of marine mammals if certain findings are made (16 U.S.C. 1361 et seq.). An authorization shall be granted if NMFS finds that the specified activity results in the taking of small numbers and would have a negligible impact on the species or stock(s), and would have an immitigable adverse impact on the availability of the species or stock(s) for subsistence uses, and if the permissible methods of taking, mitigation, monitoring and reporting of such takings are set forth.

We analyze the estimate of takes requested relative to these requirements in Section 7 of this application.

6. TAKE ESTIMATES FOR MARINE MAMMALS

In September 2016, JASCO Applied Sciences Ltd. (JASCO) completed a preliminary acoustic impact study of pile driving sounds for the Haines Ferry Terminal Modification project. This early study computed the extent of ensonified areas by using pile driving sound levels commonly found in the literature from prior measurements, including those measured for AK DOT at Kake, Auke Bay, and Ketchikan. To account for the reduction of acoustic energy as a result of increasing distance from the pile, received sound levels at distance were computed assuming a constant acoustic decay factor, an approach commonly referred to as the Practical Spreading Loss Model. This type of approach, although computationally efficient for fast assessments, can over- or under-estimate acoustic sound levels. After completing the preliminary analysis, a more sophisticated approach was taken to apply physical models of pile driving and ocean sound propagation. This was done to more accurately assess the extent of ensonification from pile driving activities, and to define zones of potential effects on marine fauna based on sound level thresholds for Level A and Level-B impacts. The results from the more sophisticated approach were used for this Application (see Quijano *et al.* 2016).

JASCO's Pile Driving Source Model (PDSM) was used to simulate the sound the pile radiated during either impact or vibratory pile driving. The Full Waveform Range-dependent Acoustic Model (FWRAM) then simulated sound propagation from the pile through the water column. This is a more sophisticated approach than using a constant transmission loss coefficient and a simpler model such as the practical spreading loss model. JASCO's propagation model computes the transmission loss between the source location (i.e. the pile) and a grid of points throughout the surrounding water by simulating the propagation of fluctuations of a sound pressure wave under the influence of the local environmental conditions. The computed transmission loss values are added to the source sound levels and FWRAM outputs received sound levels at each point in the modeled grid. The TL coefficients from the empirical studies represent a simplified approximation of the sound propagation that is not directly comparable to the FWRAM output. The inputs to FWRAM include activity-specific source levels, bathymetry, the water sound speed profile, and seabed geoacoustic parameters. The models generate 2-D and 3-D sound level grids in several frequency bands that were weighted according to the audiometric sensitivity of the marine mammal species.

Modeled results are presented as tables of distances at which sound pressure levels or sound exposure levels fell below certain thresholds defined by criteria. For marine mammal injury, the Level A thresholds considered here follow the NMFS guidelines (NMFS 2016). Marine mammal disturbance is assessed relative to the Level B thresholds based on the interim NMFS criteria (NMFS 2013b). Results are also presented as sound field isopleth maps, which show the planar distribution of sound levels with range and azimuthal direction (see Appendices B and C).

6.1. Sound Threshold Levels

The criteria for sound exposure threshold levels as applied in this study are based on references that represent the current best available science, and require computing peak pressure level (PK), sound pressure level (SPL), and sound exposure level (SEL). Appendix B describes these metrics and provides formulae. Results of the modeling study are presented in terms of the following noise criteria:

- Dual criteria (Auditory-weighted SEL and PK) Level A thresholds for marine mammals, based on NMFS (2016) for all sound sources.
- Level B thresholds for marine mammals, based on the interim NMFS criteria (NMFS 2013) of 120dB re 1 µPa SPL for non-impulsive and 160 dB re 1 µPa SPL for impulsive sound sources.

Maps that correspond to Level A and Level B criteria are presented in Appendix C.

The potential for noise to affect animals depends on how well the animals can hear it. Noises are less likely to disturb or injure an animal if they are at frequencies that the animal cannot hear well. An exception occurs when the sound pressure is so high that it can physically injure an animal by non- auditory means (i.e., barotrauma). For sound levels below such extremes, the importance of sound components at particular frequencies can be scaled by frequency weighting relevant to an animal's sensitivity to those frequencies (Nedwell and Turnpenny 1998, Nedwell *et al.* 2007). These frequency- dependent scaling functions are known as auditory weighting functions.

In July 2016, NMFS published its revised acoustic injury criteria that are based on peak (PK) and frequency-weighted SELs (NMFS, 2016). The criteria depend on the hearing sensitivity of five marine mammal hearing groups as characterized in Southall et.al. (2007): low-frequency cetaceans (LFC), mid-frequency cetaceans (MFC), high-frequency cetaceans (HFC), phocid pinnipeds in water (PPW), and otariid pinnipeds in water (OPW). The parameters are defined uniquely for each functional hearing group (Table 6-1). Of the six marine mammal species (four cetaceans and two pinnipeds) that may occur in the Action Area, humpback whales are classified as LFC, killer whales are MFC and harbor porpoise and Dall's porpoise are classified as HFC (Southall *et al.* 2007). Additionally, harbor seals are members of the PPW group, while Steller sea lions are grouped under the OPW.

TABLE 6-1 PARAMETERS FOR THE RELEVANT AUDITORY WEIGHTING FUNCTIONS

Hearing group	NMFS				
	a	*b*	*f1* (kHz)	*f2* (kHz)	*C* (dB)
Low-frequency cetaceans	1	2	0.20	19	0.13
Mid-frequency cetaceans	1.6	2	8.8	110	1.20
High-frequency cetaceans	1.8	2	12	140	1.36
Otariids and other non-phocid marine carnivores in water	2	2	0.94	25	0.64
Phocids in water	1	2	1.9	30	0.75

NMFS 2016

For purposes of this application we apply the specific methods and Level A thresholds summarized by NMFS (2016, Table 6-2). The Level A criteria provide cautionary estimates of levels above which acoustic exposure may lead to loss of hearing, a process known as permanent hearing threshold shift (PTS).

TABLE 6-2 ACOUTSTIC THRESHOLDS FOR LEVEL A INJURY

Hearing group	Impulsive source		Non-impulsive source
	Peak pressure level (dB re 1 μPa)	Auditory-weighted SEL24h (dB re 1 μPa²·s)	Auditory-weighted SEL24h (dB re 1 μPa²·s)
Low-frequency cetaceans	219	183	199
Mid-frequency cetaceans	230	185	198
High-frequency cetaceans	202	155	173
Phocid pinnipeds in water	218	185	201
Otariid pinnipeds in water	232	203	219

NMFS, 2016

Level B Harassment is defined as sound levels that exceed those that could disturb a marine mammal. For impulsive sounds, the threshold for Level B Harassment is a sound pressure level (SPL)15 of 160 dB re 1 μPa for pinnipeds and cetaceans (NMFS 2014). NMFS has implemented a lower threshold of 120 dB re 1 μPa rms SPL for animals exposed to non-impulsive sources, and occasionally to species of special concern.

6.2. Modeling Methodology

The following sections provide a brief description of the methods used to model sound levels that could be generated during Project activities. Detailed modeling methodology is provided in Warner and Austin (2016b).

To model sounds resulting from impact and vibratory pile driving of cylindrical pipes, JASCO's Source PDSM, a physical model of pile vibration and near-field sound radiation (MacGillivray 2014), was used in conjunction with the GRLWEAP (2010 wave equation model (GRLWEAP, Pile Dynamics 2010) to obtain an equivalent pile source signature consisting of a vertical array of discrete point sources (Appendix B). This signature accounts for several parameters that describe the operation: pile type, material, size, and length; the pile driving equipment; and approximate pile penetration rate. The amplitude and phase of the point sources along the array were computed so that they collectively mimicked the time-frequency characteristics of the acoustic wave at the pile wall that results from a hammer strike (impact driving) or from forced vibration (vibratory driving) at the top end of the pile. JASCO's PDSM yielded the underwater received sound pressure levels at a 10 m (33 ft.) range as shown in Table 6-3.

TABLE 6-3 RECEIVED SOUND PRESSURE LEVELS AT 10 M (33 FT.)

	Sound Pressure Level @ 10m (dB re 1μPa)	
	Impact	Vibratory
30-in. pile	188.5	177.6
36-in. pile	189.9	179.8

[15] Sound level is usually defined in terms of something called Sound Pressure Level (SPL). SPL is actually a ration of the absolute, Sound Pressure and a reference level (usually the Threshold of Hearing) or the lowest intensity sound that can be heard by most people). SPL is measured in decibels (dB).

JASCO's Full Waveform Range-dependent Acoustic Model (FWRAM) sound propagation modeling code was used to determine received levels as a function of depth, range, and azimuth direction. The underwater sound fields predicted by the propagation models were sampled so that the received sound level at each geographic location (horizontal plane) was set to the maximum value of all modeled depths at that location. Two distances from the source are reported for each sound level: (1) R_{max}, the maximum range over all azimuths (through 360°) at which the given sound level threshold was encountered, and (2) $R_{95\%}$, the maximum range at which the given sound level is encountered after the 5 percent farthest such points were excluded (see Warner and Austin 2016b).

For modeling, pile driving was assumed to take place in the deepest water at the Terminal site (26.9 m or 95 ft. deep). This was done as a precautionary measure, since noise generation at the pile and its subsequent propagation along the water column is generally enhanced in deeper water, as a result of a larger portion of the pile being in the water, as well as better sound propagation characteristics in deeper water. For this reason, site specific modeling was conducted for the Haines project location taking into account the bathymetry, seafloor type, and water column properties specific to the project area. Impact pile driving and vibratory pile removal and driving were considered separately in the model since one (impact) is an impulsive sound source and the other (vibratory) is a continuous sound source. The total sound energy in a 24-hour period was computed for each method of installation. Source levels were calculated using JASCO's PDSM, which simulates the sound pressure waves generated at the pile. Eight modeling scenarios were included in this study. Scenarios included removal or driving one or two piles per day (30 and 36 in.) using vibratory or impact methods.

The sound propagation model FWRAM requires inputs to describe the underwater environment because that is the medium through which sound from pile driving operations propagates. The data required to parameterize the models includes:

- Bathymetry or the water depths throughout the modeled area.
- Sound Speed Profile (SSP) provides the values of sound speed as a function of water depth representing the mean conditions throughout the modeled area.
- Geoacoustic Profile. Seafloor properties influence underwater sound propagation because they affect the transmission of energy at the water-bottom interface and through underlying layers.

6.3. Acoustic Source Parameters

Steel cylindrical pipe piles 41 m (135 ft.) long with ½ in. thick walls were modeled for a total penetration of 14 m. (46 ft.) into the sediment. In the case of vibratory pile driving, both pile sizes were assumed to be driven by an ICE-44B vibratory pile driver. For impact pile driving, the parameters corresponding to the Delmag D30-32 and D36-32 impact pile drivers were used to model scenarios with 30 in. and 36 in. diameter piles, respectively (Table 6.4). Sound energy was accumulated over a specified number of hammer strikes, not as a function of time. The number of strikes required to install a single pile (assumed to be 700 strikes per pile) was estimated based on pile driving logs from another pile driving project at Haines. Sound footprints were calculated for the installation of two piles (thus, accumulated over 1400 strikes) under that assumption that two piles, at most, could be installed in a 24-hour period (see Section 2). For vibratory pile driving, sound energy was accumulated over 3600 seconds (1 hour) per pile, and 2 hours for the two piles that could be removed or installed in a 24-hour period. For each combination of pile/pile driver, the force at the top of the pile generated by the driver was computed using GRLWEAP 2010 wave equation model and input to JASCO's PDSM (Warner and Austin 2016b).

The modeling approach yielded per-pulse or per-second SEL for impact or vibratory pile driving, respectively. Information on the total number of strikes (impact) or the total number of seconds (vibratory) required to install a single pile was used to obtain SEL over 24 hours by applying the following equation:

$$24\text{-}hr\ SEL = per\text{-}blow\ or\ per\text{-}second\ SEL + 10 \times log_{10} N_{24h}$$

where N_{24h} represents either the total number of hammer blows for impact pile driving, or the total number of seconds of vibratory pile driving, over 24 hours.

The total number of hammer blows for impact pile driving was calculated by:

$$N_{24h} = Piles\ per\ day \times Number\ of\ strikes\ to\ full\ penetration$$

The total number of seconds for vibratory pile driving was calculated by:

$$N_{24h} = Piles\ per\ day \times Time\ to\ full\ penetration\ per\ pile$$

TABLE 6-4 MODEL PARAMETERS FOR IMPACT AND VIBRATORY PILE DRIVING

Driving Mechanism	Pile Driver	Energy (kNm, impact) or Force (kN, vibratory)	Pile Diameter (in.)	Time to Full Pile Installation
Impact	Delmag D30-32	102.3 kNm	30	700 strikes
	Delmag D36-32	122.8 kNm	36	
Vibratory	ICE-44B	1789 kN	30 and 36	3600 seconds

6.4. Distances to Level A and Level B Sound Thresholds

This section presents the distances to marine mammal Level A and Level B thresholds for impact (Table 6-5 and Table 6-6) and vibratory (Table 6-7 and Table 6-8) removal or driving of cylindrical steel pipe piles. The distances are based on NMFS (2016) and the interim NMFS (2013) criteria for Level A and Level B, exposures, respectively. NMFS has formally specified that these are the current criteria to be used to assess injury resulting from exposures to pile driving, and other impulsive and non-impulsive noise sources. Acoustic contour maps, which show the directivity and range to various sound level isopleths, are presented in Appendix C. In several cases, topographic features would block sound propagation before levels reach the thresholds.

The underwater sound fields predicted by the propagation models were sampled so that the received sound level at each geographic location (horizontal plane) was set to the maximum value of all modeled depths at that location. Two distances from the source are reported for each sound level: (1) R_{max}, the maximum range over all azimuths (through 360°) at which the given sound level threshold was encountered, and (2) $R_{95\%}$, the maximum range at which the given sound level is encountered after the 5 percent farthest such points were excluded (Tables 6-5 through 6-8). The R_{95}% value is useful for non-circular noise footprints and when a few anomalously high amplitudes along a few azimuths skew the results. Regardless of the geometric shape of the maximum-over-depth footprint, $R_{95\%}$ is the predicted range encompassing at least 95 percent of the area that would be exposed to sound at or above that level. The difference between R_{max} and $R_{95\%}$ depends on the source directivity and the heterogeneity of the acoustic environment. The $R_{95\%}$ excludes ends of protruding areas or small isolated acoustic foci not representative of the nominal ensonification zone.

The reported radii for 24-hr SEL Level A thresholds are based on the assumption that marine mammals remain stationary or at a constant exposure range during the entire period, which for the relatively short estimated distances, in practical terms represents an unlikely worst- case scenario. These analyses were used in the estimation of takes by species and month for marine mammals potentially impacted by the proposed activities of the project.

TABLE 6-5 IMPACT PILE DRIVING 30-IN. PILES

Criteria	Functional hearing group	Threshold (auditory weighting function)	One pile			Two piles		
			R_{max} (km)	$R_{95\%}$ (km)	Area (km²)	R_{max} (km)	$R_{95\%}$ (km)	Area (km²)
Level A (NMFS 2016)	**SEL_{24h}**							
	Low-frequency cetaceans	183 dB re 1 µPa²·s	1.71	0.87	0.89	2.88	1.65	3.17
	Mid-frequency cetaceans	185 dB re 1 µPa²·s	-	-	-	-	-	-
	High-frequency cetaceans	155 dB re 1 µPa²·s	0.81	0.52	0.44	1.70	1.45	1.13
	Phocid pinnipeds in water	185 dB re 1 µPa²·s	0.25	0.18	0.05	0.34	0.26	0.09
	Otariid pinnipeds in water	203 dB re 1 µPa²·s	-	-	-	-	-	-
	PK							
	Low-frequency cetaceans	219 dB re 1 µPa	-	-	-	N/A		
	Mid-frequency cetaceans	230 dB re 1 µPa	-	-	-			
	High-frequency cetaceans	202 dB re 1 µPa	0.10	0.09	< 0.01			
	Phocid pinnipeds in water	218 dB re 1 µPa	-	-	-			
	Otariid pinnipeds in water	232 dB re 1 µPa	-	-	-			
Level B (NMFS 2013; NOAA 2013)	**SPL**							
	All marine mammals	160 dB re 1 µPa	3.35	1.98	4.52	N/A		

Threshold distances based on NMFS (2016) Level A criteria, and NMFS (2014) Level B interim criteria. N/A means "Not applicable", since PK- and SPL-based metrics are computed from the pressure waveform trace corresponding to a single impact pile driving strike. A dash in table cells indicates that threshold was not reached.

TABLE 6-6 IMPACT PILE DRIVING 36-IN. PILES

Criteria	Functional hearing group	Threshold (auditory weighting function)	One pile			Two piles		
			R_{max} (km)	$R_{95\%}$ (km)	*Area* (km²)	R_{max} (km)	$R_{95\%}$ (km)	*Area* (km²)
Level A (NMFS 2016)	**SEL_{24h}**							
	Low-frequency cetaceans	183 dB re 1 µPa²·s	2.18	1.54	1.67	3.05	2.04	4.78
	Mid-frequency cetaceans	185 dB re 1 µPa²·s	-	-	-	-	-	-
	High-frequency cetaceans	155 dB re 1 µPa²·s	1.68	0.79	0.77	2.19	1.49	2.17
	Phocid pinnipeds in water	185 dB re 1 µPa²·s	0.29	0.23	0.07	0.42	0.33	0.15
	Otariid pinnipeds in water	203 dB re 1 µPa²·s	-	-	-	-	-	-
	PK							
	Low-frequency cetaceans	219 dB re 1 µPa	-	-	-	N/A		
	Mid-frequency cetaceans	230 dB re 1 µPa	-	-	-			
	High-frequency cetaceans	202 dB re 1 µPa	0.10	0.09	0.02			
	Phocid pinnipeds in water	218 dB re 1 µPa	< 0.01	< 0.01	< 0.01			
	Otariid pinnipeds in water	232 dB re 1 µPa	-	-	-			
Level B (NMFS 2013; NOAA 2013)	**SPL**							
	All marine mammals	160 dB re 1 µPa	4.19	2.67	6.79	N/A		

Threshold distances based on NMFS (2016) Level A criteria, and NMFS (2014) Level B interim criteria. N/A means "Not applicable", since PK- and SPL-based metrics are computed from the pressure waveform trace corresponding to a single impact pile driving strike. A dash in table cells indicates that threshold was not reached.

TABLE 6-7 VIBRATORY PILE REMOVAL AND DRIVING 30-IN. PILES

Criteria	Functional hearing group	Threshold (auditory weighting function)	One pile			Two piles		
			R_{max} (km)	$R_{95\%}$ (km)	*Area* (km^2)	R_{max} (km)	$R_{95\%}$ (km)	*Area* (km^2)
Level A (NMFS 2016)	**SEL_{24h}**							
	Low-frequency cetaceans	199 dB re 1 µPa²·s	-	-	-	-	-	-
	Mid-frequency cetaceans	198 dB re 1 µPa²·s	-	-	-	-	-	-
	High-frequency cetaceans	173 dB re 1 µPa²·s	-	-	-	-	-	-
	Phocid pinnipeds in water	201 dB re 1 µPa²·s	-	-	-	-	-	-
	Otariid pinnipeds in water	219 dB re 1 µPa²·s	-	-	-	-	-	-
Level B (NMFS 2013; NOAA 2013)	**SPL**							
	All marine mammals	120 dB re 1 µPa	6.45*	5.61	21.14	N/A		

Threshold distances based on NMFS (2016) Level A, and NMFS (2014) Level B interim criteria. A dash in table cells indicates that threshold was not reached. N/A means "Not applicable", SPL-based metrics are computed from the pressure waveform trace corresponding to a single vibratory pile driving event.
*Limited by land

TABLE 6-8 VIBRATORY PILE DRIVING 36-IN. PILES

Criteria	Functional hearing group	Threshold (auditory weighting function)	One pile			Two piles		
			*R*max (km)	*R*95% (km)	*Area* (km²)	*R*max (km)	*R*95% (km)	*Area* (km²)
Level A (NMFS 2016)	**SEL24h**							
	Low-frequency cetaceans	199 dB re 1 µPa²·s	-	-	-	0.02	0.02	<0.01
	Mid-frequency cetaceans	198 dB re 1 µPa²·s	-	-	-	-	-	-
	High-frequency cetaceans	173 dB re 1 µPa²·s	-	-	-	-	-	-
	Phocid pinnipeds in water	201 dB re 1 µPa²·s	-	-	-	-	-	-
	Otariid pinnipeds in water	219 dB re 1 µPa²·s	-	-	-	-	-	-
Level B (NMFS 2013; NOAA 2013)	**SPL**							
	All marine mammals	120 dB re 1 µPa	6.46*	5.62	21.17	N/A		

N/A means "Not applicable", since SPL-based metrics are computed from the pressure waveform trace corresponding to a single vibratory pile driving event. Threshold distances based on NMFS (2016) Level A criteria for injury, and NMFS (2014) Level B interim criteria. A dash in table cells indicates that threshold was not reached.

*Limited by land

Tables 6-9 and 6-10 show Level A and B ensonified areas for vibratory and impact driving used in calculating take estimates. Distances for impact pile driving are based on the auditory-weighted sound exposure levels, which exceeded the corresponding ranges for the peak thresholds. These ensonified sound fields are shown in Appendix C.

TABLE 6-9 ENSONIFIED AREAS (KM²) FOR LEVEL A THRESHOLDS, IMPACT AND VIBRATORY METHODS OVER 24 HR PERIOD

	1 Pile					2 Piles				
	LFC	**MFC**	**HFC**	**PPW**	**OPW**	**LFC**	**MFC**	**HFC**	**PPW**	**OPW**
Impact										
30 in	0.89	-	0.44	0.05	-	3.17	-	1.13	0.09	-
36 in	1.67	-	0.77	0.07	-	4.78	-	2.17	0.15	-
Vibratory										
30 in	-	-	-	-	-	-	-	-	-	-
36 in	-	-	-	-	-	<0.01	-	-	-	-

TABLE 6-10 ENSONIFIED AREAS (KM^2) FOR LEVEL B THRESHOLDS FOR IMPACT AND VIBRATORY METHODS

	Impact Hammering (160 dB)	Vibratory Driving (120 dB)
30	4.52	21.1
36	6.79	21.1

6.5. Vibratory and Impact Pile Driving Airborne Noise

Airborne noises could also affect pinnipeds. However, noise generated during vibratory would reach the harbor seal in-air threshold (90 db) at approximately 34 m (112 ft.) and is below the other pinnipeds threshold. The in-air threshold for driving 30 in. diameter pipe (110 dB at 15 m [50 ft.]) would reach the harbor seal threshold (90 dB) at approximately 152 m (500 ft.), and the other pinnipeds (Steller sea lions) threshold (100 dB) at approximately 48 m (158 ft.).

Therefore, during impact pile driving, temporary in-air disturbance would be limited to harbor seals and sea lions swimming on the surface through the immediate Terminal area within 152 m (500 ft.), and within 48 m (158 ft.), respectively. At this distance any animal swimming would already have been ‘taken’ by the in-water noise levels; therefore, in-air disturbance is generally not considered for pinnipeds swimming near the project site. Further, mitigation would prevent a ‘take’ from either occurring at these distances (see Section 11) or becoming a serious injury.

There are no permanent haulouts that occur within the calculated harassment zones from the proposed activities at the Terminal. The nearest documented harbor seal haul out site to the Terminal is Pyramid Island located approximately 6.4 km (4 miles) southwest, around Chilkat Peninsula and up the Chilkat Inlet. The site is outside any area influenced by noise-generating activities for this project due to the configuration of the coastline and the unlikely effect that noise could spread to the haulout site due to the physical barrier of Chilkat Peninsula. The closest documented Steller sea lion haul out site to the Terminal is approximately 22.5 km (14 miles) southeast on Gran Point, Lynn Canal, and is also outside any area influenced by the noise-producing activities at the Terminal due to the configuration of the coastline and blocking of sound generated from the Project site.

For these reasons, in-air noise is not considered further in this document.

6.6. Estimated Takes

6.6.1. Marine Mammal Densities

The abundance of the six marine mammal species (by month) in the Action Area (Table 6-11) was estimated using available survey data, literature, sightings from MMOs for other projects (Skagway Project), and personal communication from researchers and state and Federal biologists. The density was calculated by dividing the estimated monthly abundance for each species (the number used to calculate densities for each species was provided in Section 4.1 through 4.6) by the area (in km^2) that best encompasses all of the marine mammals potentially taken during the activities of this Project (Action Area).

The abundance of marine mammals in the Action Area fluctuates seasonally; the months when all species have the greatest probability of occurring is mid-April through July. As described in Section 1.2.1, the Action Area extends from Lutak Inlet/Chilkat River south down Lynn Canal to the Gran Point haulout for Steller sea lions. The Action Area is approximately 91.3 km^2 and includes the greatest densities of foraging sea lions and harbor seals in northern Lynn Canal at any time of the year. Additionally, seasonal peak occurrences of all other marine mammal species considered in this IHA application also occur within this geographic boundary. Therefore, 91.3 km^2 was used to estimate the marine mammal densities shown in Table 6-11.

The data on marine mammals in this area are diverse and fairly robust (see Section 4). Due to the strong seasonal occurrences of marine mammals in this area, density estimates for each species were estimated by month (Table 6-11) rather than by using an average density calculated over a 12-month period. For example, we have already discussed the seasonality of Steller sea lions and how prey aggregations affect their abundance. Similarly, humpback whales are present in the Action Area from mid-April through June, and are generally absent from mid-July throughout the remainder of the year. Therefore, for each species calculated monthly or seasonal density estimates were used to estimate take levels throughout the year. Details regarding the presence of each of these species in the Project area are provided in Section 4.

TABLE 6-11 MARINE MAMMAL DENSITY ESTIMATES/DAY (ANIMALS/KM^2)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Harbor Seals	0.109	0.109	1.09	1.09	1.09	1.09	0.109	0.109	0.109	0.109	0.109	0.109
Steller Sea Lions	2.06	1.87	2.49	7.63	11.85	7.55	1.35	0.00	0.01	1.85	1.59	2.47
Humpback Whales	0.00	0.00	0.00	0.054	0.054	0.054	0.054	0.022	0.022	0.022	0.022	0.00
Killer Whales	0.00	0.00	0.00	0.054	0.054	0.054	0.054	0.054	0.054	0.054	0.054	0.00
Harbor Porpoise	0.054	0.054	0.054	0.054	0.054	0.054	0.054	0.054	0.054	0.054	0.054	0.054
Dall’s Porpoise	0.00	0.00	0.00	0.00	0.00	0.00	0.03	0.03	0.03	0.03	0.00	0.00

6.6.1.1. Harbor Seals

Harbor seals are generally present in the Action Area throughout the year, but their local abundance is clearly defined by the presence of available prey. During mid-March through mid- June, they are abundant in Lutak Inlet. For these months, an average of 100 seals per day in the inlet is considered a conservative estimate, based on personal communication with researchers (see Section 4). Before and after the peak spring period, seal numbers are considerably lower, and may be lower than portrayed in these estimates. Therefore, an estimate of 10 seals per month was used for the remainder of the year.

From October through January most of the seals estimated to be in the area (approx. 100) haul-out in the Chilkat Inlet/River on Pyramid Island and forage on late season salmon runs in the river. The Chilkat Inlet and River are blocked by topographic features from the Terminal and would not be affected by elevated in-water sounds/proposed activities at the Terminal. Therefore, these numbers may over-estimate potential take during the winter months for this species.

6.6.1.2. Steller Sea Lions

Monthly Steller sea lion abundance numbers were taken from surveys conducted at Gran Point[16]. The abundance of Steller sea lion at the Project site fluctuates seasonally; the peak occurrence is in May when sea lions are foraging on eulachon and herring in Lutak Inlet and range up to the Chilkat River (directly in-front of, and adjacent to the Terminal). The Gran Point haulout is the largest sea lion haulout in the region. It has been demonstrated that animals at this location feed almost exclusively in Lutak Inlet during the spring eulachon runs and either raft-up and remain in the inlet, or move back-and-forth between the foraging site and the haulout (Womble *et al.* 2005). Therefore, Steller sea lion densities in the Action Area were estimated using the average number of sea lions per month from Gran Point data. These estimates may also be inflated during late-fall and winter as many sea lions at Gran Point begin moving south to Benjamin Island to forage on herring moving back into southern Lynn Canal.

Steller sea lions from the western DPS are present at this haulout in extremely limited numbers. However, for purposes of this analysis, we have considered the western DPS of sea lions in the take estimates.

6.6.1.3. Humpback Whales

Humpback whales occur in relatively low numbers seasonally in the Project area for brief periods; by mid-July they vacate the area following large aggregations of forage fish in lower Lynn Canal. As humpback whales are generally present during mid- to late spring in the Action Area, densities were calculated assuming that five whales would be present over the period April through July (based on MOS 2016). Given that a few whales have atypically remained in the area through the fall months (MOS 2016), we assumed that two whales may remain within the Action Area from August through November, but would be absent for the remainder of the year. All humpback whales potentially encountered are assumed to be from the Hawaii DPS; however, to be precautionary we are requesting one take per month be apportioned to the Mexico DPS.

6.6.1.4. Killer Whales

Killer whales in the Action Area and throughout upper Lynn Canal are either from the Alaska Resident Stock or the West Coast Transient Stock. The occurrence of transient killer whales increases in summer following pupping season, and lower numbers are observed in spring and fall, consistent with sighting information in the immediate location of the Terminal (K. Hastings, pers. comm.). Densities were calculated assuming five animals enter the area seasonally from one of the resident or transient stocks in the area, and may remain from April through November.

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[16] Note these numbers do not distinguish between the Eastern DPS and Western DPS of sea lions occupying Gran Point. The number of western DPS sea lions is less than 0.001 percent of the total.

6.6.1.5. Harbor Porpoise

Harbor porpoise are present throughout the year in upper Lynn Canal, but may not be present in the immediate vicinity of the Terminal at all times of the year. Local observer data indicate that small groups of two or three animals have seen; this number is higher than that taken from aerial data. Opportunistic sightings occur throughout the year (J. Womble, person. comm.). Therefore, densities were calculated using five animals per day as a likely number that could be present in the area at any given time.

6.6.1.6. Dall's Porpoise

The species has been documented as far north as Haines in the open waters of Upper Lynn Canal. The mean group size of Dall's porpoise in Southeast Alaska is estimated at three individuals (Dahlheim *et al.* 2009). However, larger groups are considered common in the Action Area therefore densities were based on an average group size of 10 animals to be precautionary. Dall's porpoise have not been observed in the waters of Lutak Inlet immediately adjacent to the Terminal, and would not be affected by activities there. However, the Level B ensonified areas for HFCs extend across the upper portion of Lynn Canal. Therefore, takes may occur prior to detection of a group of animals. Thus, takes are requested for this species. Densities were calculated assuming that ten animals are always present within the Action Area from late summer into fall (June through October).

6.6.2. Estimated Incidental Take

The potential for incidental take is estimated for each species by determining the likelihood that a marine mammal would be present within a Level A or Level B zone of influence (ZOI) during active pile driving. Potential take is estimated by multiplying the Level A or Level B ensonified area (km^2) by the density estimates for marine mammals, providing the number of animals that might occupy the ensonified area at any given moment or within a day. The number of animals that might be exposed per day is then multiplied by the number of days of pile driving (assuming two piles are driven per day) to estimate total take (11 days for impact driving 30-in. diameter piles, and eight days for 36-in. diameter piles). For example, the potential number of Level A takes for harbor porpoise that might occur during January is calculated as follows:

> *30-in. pile driving Level A area (1.13 km^2) x density (0.054 animals/ km^2) = 0.06 porpoise/day times the number of 30-in. diameter impact pile driving days (11) = 0.67 Level A takes of harbor porpoise in January (30-in. diameter pile only); plus 36-in. impact pile driving Level A area (2.17 km^2) x density (0.054 animals/ km^2) = 0.117 porpoise/day times the number of 36-in. diameter impact pile driving days (8) = 0.94 Level A takes of harbor porpoise in January (36-in. diameter pile only). Together the potential number of Level A takes for harbor porpoise in January is 1.61 takes*

These estimates assume:

- Animals occurring within the Level A and Level B ensonified zones are considered to be in each zone simultaneously (i.e., the area where Level A and Level B zones overlap counts the animal in each area and would therefore present the worst-case scenario (i.e., maximum number);
- Exposures are based on total number of days that 30-in pile removal and/or driving could occur, plus the total number of days that 36-in pile driving could occur;

- One day equates to any length of time that piles are driven whether it is a partial day or a 24-hour period;
- All marine mammal individuals potentially occurring in the Project area are assumed to be incidentally taken;
- An individual animal can only be taken once during a 24-hour period; and
- Exposures to sound levels at or above the relevant thresholds equate to take, as defined by the MMPA. Therefore, all permitted pinnipeds and cetaceans that come within effective harassment zones for pile driving activities would be recorded as potential exposures. If a non-permitted marine mammal is observed approaching a harassment zone then pile driving would shut down;
- Takes by acoustical harassment would only occur during those days when pile driving occurs. Tables 6-12 and 6-13 provide an estimate of take for each month by species, assuming pile driving would occur during that month. This provides a comparison by month of potential exposure, therefore take, during pile driving.

Potential take estimates may overestimate the actual number of individuals taken, assuming that available population data and modeled threshold areas or zones are accurate. For example, we assume, in the absence of information supporting a more refined conclusion, that the output of the calculation represents the number of individuals that may be taken by the specified activity. In fact, in the context of stationary activities such as pile driving in areas where resident animals may be present, this number represents the number of instances of take that may occur to a small number of individuals, with a notably smaller number of animals actually being exposed more than once per individual. While pile driving can occur any day throughout the in-water work window, and the analysis is conducted on a per day basis, only a fraction of that time (typically a matter of hours on any given day) is actually spent pile driving. The potential effectiveness of mitigation measures in reducing the number of takes is typically not quantified in the take estimation process. For these reasons, take estimates are conservative and worst-case, especially if each take is considered for a separate individual animal. This is especially true for pinnipeds.

6.6.2.1. Estimated Level A Incidental Take

Level A incidental take is estimated for each species by month by determining the likelihood that a marine mammal would be present within a Level A area ZOI during active pile driving (Table 6-12). Typically, potential take is estimated by multiplying the Level A ensonified area from pile driving (30 in. and 36 in. see Table 6-9) by the local marine mammal density in animals/km^2 (Table 6-11). This provides an estimate of the number of animals that might occupy the Level A ensonified area at any given moment, or within a day. The number of animals that might be exposed per day is then multiplied by the number of days of pile driving to estimate total take.

TABLE 6-12 ESTIMATES OF LEVEL A TAKE FOR ALL PILE DRIVING ACTIVITIES

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Harbor Seals	0.26	0.26	1.21	1.21	1.21	1.21	0.12	0.12	0.12	0.12	0.12	0.12
Steller Sea Lions	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Humpback Whales	0.00	0.00	0.00	3.95	3.95	3.95	3.95	1.61	1.61	1.61	1.61	0.00
Killer Whales	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Harbor Porpoise	1.61	1.61	1.61	1.61	1.61	1.61	1.61	1.61	1.61	1.61	1.61	1.61
Dall’s Porpoise	0.00	0.00	0.00	0.00	0.00	0.89	0.89	0.89	0.89	0.89	0.00	0.00

A review of Table 6-12 indicates:

- Potential Level A take is dependent upon month due to the seasonality of species in the Action Area, but could occur each month of the year for at least one of the species considered;
- Based on the analysis, Level A incidental take requests are necessary for several of the species found within the Project Area; however, no mortality or serious injury is expected;
- Harbor porpoise and humpback whales have the potential for more Level A takes per month than other species. This is due to the larger ensonified threshold areas calculated for these species (based on NMFS 2016) during impact pile driving;
- December through February has the fewest number of potential Level A takes for cetaceans;
- August through February has the fewest number of possible Level A takes for pinnipeds (harbor seals only),
- Level A take for the ESA-listed Mexico DPS of humpback whales is not requested due to the high improbability that an individual from this DPS would be in the Action Area;
- Take estimates do not currently consider mitigation and are considered the worst-case scenario.

6.6.2.2. Estimated Level B Incidental Take

Estimates of Level B take (by month) are presented in Table 6-13. Estimates of Level B take reflect both the large areas of calculated harassment zones that are ensonified during pile removal and driving, and the seasonal periods of peak abundance within the Action Area.

TABLE 6-13 ESTIMATES OF LEVEL B TAKE FOR ALL PILE DRIVING ACTIVITIES

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Harbor Seals	59.5	59.5	59.5	595	595	595	59.5	59.5	59.5	59.5	59.5	59.5
Steller Sea Lions	1,127	1,023	1,362	4,175	6,483	4,131	738	0.00	5.5	1,012	869	1,351
Humpback Whales	0.00	0.00	0.00	27.5	27.5	27.5.9	27.5	12.8	12.8	12.8	12.8	0.00
Killer Whales	0.00	0.00	0.00	29.6	29.6	29.6	29.6	29.6	29.6	29.6	29.6	0.00
Harbor Porpoise	28.6	28.6	28.6	28.6	28.6	28.6	28.6	28.6	28.6	28.6	28.6	28.6
Dall's Porpoise	0.00	0.00	0.00	0.00	0.00	15.9	15.9	15.9	15.9	15.9	0.00	0.00

6.6.3. Level A and Level B Take Requests Relative to Optimal Timing of Pile Driving

The optimal period for pile driving would begin July 1 then run from through September. Pinnipeds are leaving this area by the end of June, and remain largely absent throughout summer. During this period, pile removal or pile driving activities would not occur over 21 consecutive days; rather they could occur for several days during any month within this three- to four-month window. Based on previous similar projects, it is likely that pile removal would occur quickly and pile driving would occur for a few days, followed by a period with no pile driving. A potential benefit of pauses between pile driving is that it would allow the animal(s) subjected to an increased noise level to return to pre-exposure conditions on a near daily basis in-between periods of pile driving.

For the purposes of the take estimate, we assume pile driving could occur at any period during the four-month window. To be precautionary, we have calculated a scenario for requesting take based on the maximum number of potential takes that could occur during the four-month period. Therefore, the number of takes requested is the maximum number of Level A and Level B takes per month for each species between June and September, and using average group size rather than average density for species that travel in known groups (e.g. Dall's porpoise).

This request recognizes the pile driving would likely be spread intermittently throughout the four-month period, and the number of potential takes would be fewer than that requested. The requested number of takes is driven by June density estimates for all species except Dall's porpoise, which are based on density estimates that are consistent throughout the period. Therefore, this request reflects the maximum number of Level A and Level B takes that could occur (worst case scenario) for this three- to four-month period. Table 6-14 presents the number of takes for Level A and Level B acoustical harassment authorization that are being requested.

TABLE 6-14 ACOUSTICAL HARASSMENT LEVEL A AND LEVEL B TAKE REQUESTS (UNMITIGATED)

Species	Level A Take Request (June -September)	Level B Take Request (June -September)
Harbor Seal	3	598
Steller Sea Lion - eastern DPS	0	4,048
Steller Sea Lion - western DPS	0	82
Humpback Whale - HI DPS	5	29
Humpback Whale - Mex DPS	0	1
Killer Whale	0	30
Harbor Porpoise	2	30
Dall’s Porpoise	10	17

The requested Level B takes for the ESA-listed western DPS of Steller sea lion is based on the number of marked animals (approximately 2% of total count) observed at Gran Point during recent surveys. The Mexico DPS of humpback whale is included based on the low probability of an animal from the DPS being present. These requests are considered precautionary.

7. ANTICIPATED IMPACT OF THE ACTIVITY ON SPECIES AND STOCKS

Alaska DOT&PF is requesting authorization for Level A and Level B takes by acoustical harassment of marine mammals as listed in Table 6-13. Any incidental takes would very likely be multiple takes of individuals, rather than single takes of unique individuals. This is especially valid for the requested number of Level B takes. For example, most killer whale sightings in the Action Area involve small groups of three to five animals, and often the same small group is observed multiple times over a one- to two-week period. The take calculations by stock and DPS (Tables 7-1 and 7-2) assume takes of individual animals, instead of repeated takes of a smaller number. Therefore, the take/stock percentage calculations are very conservative. The requested take numbers in relation to the overall stock or DPS size of each species are summarized in Tables 7-1 and 7-2. Stock or DPS size is repeated from Table 3-1.

TABLE 7-1 LEVEL A ACOUSTICAL HARASSMENT TAKE REQUEST (UNMITIGATED) AS PERCENT OF TOTAL STOCK

Species	Stock or DPS Size[1]	Take Request (Level A)	Take Request % of Stock	10% of Stock
Harbor Seal	9,478	3	0.03	948
Steller Sea Lion – eastern DPS	60, 131	0	0	6,013
Steller Sea Lion – western DPS	49,497	0	0	4,950
Humpback Whale – HI DPS	10,252	5	0.05	1,025
Humpback Whale - Mex DPS	3,264	0	0	326
Killer Whale – includes Alaska and Northern Residents, and West Coast Transients	2,851	0	0	285
Harbor Porpoise	11,146	2	0.02	1,115
Dall's Porpoise	No estimate	10	<0.05	>2,000

[1]From Table 3-1.

TABLE 7-2 LEVEL B ACOUSTICAL HARASSMENT TAKE REQUEST (UNMITIGATED) AS PERCENT OF TOTAL STOCK

Species	Stock or DPS Size	Take Request (Level B)	Take Request % of Stock	10% of Stock
Harbor Seal	9,478	598	6.3	948
Steller Sea Lion – eastern DPS	60, 131	4,048	6.7	6,013
Steller Sea Lion – western DPS	49,497	82	0.17	4,950
Humpback Whale – HI DPS	10,252	28	0.27	1,025
Humpback Whale - Mex DPS	3,264	1	0.03	326
Killer Whale –includes Alaska and Northern Residents, and West Coast Transients	2,851	30	1.05	285
Harbor Porpoise	11,146	30	0.27	1,115
Dall’s Porpoise	No estimate	17	<0.085	>2,000

[1]**From Table 3-1.**

7.1. Hearing Impairment and Non-auditory Injury

Permanent or temporary hearing impairment or threshold shifts (PTS or TTS) could occur when marine mammals are exposed to very loud sounds or to quieter sounds for a prolonged period. When animals are in close proximity to the sound source there is a potential for PTS or TTS. These 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, TTS include 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.

Recent efforts to revise the existing criteria, taking into account the most recent scientific data on TTS (NMFS 2014), have resulted in the revised acoustic criteria guidelines (NMFS 2016). Hearing impairment and non-auditory physical effects (e.g., stress) might occur in marine mammals exposed to strong, pulsed underwater sounds. However, the limited data available from captive marine mammals do not provide definitive evidence that any of these effects occur even for marine mammals in close proximity to sound sources. In addition, the planned monitoring and mitigation measures include shutting down equipment should animals enter specified exclusion zones to prevent Level A takes of all species.

The proposed Project would have the potential to result in Level B harassment of pinnipeds and cetaceans due to increases in noise levels associated with pile removal and installation. The potential impacts associated with Level B harassment from this Project would be temporary. Mitigation measures discussed in Section 11, would be incorporated into the Project to prevent Level A harassment, or PTS. Given the brief duration of exposure of any marine mammal in combination with the proposed monitoring and mitigation measures, auditory impairment or other non-auditory physical effects are unlikely to occur during the proposed Project.

7.1 Masking

Natural and artificial sounds can disrupt behavior by masking. The masking of communication signals by anthropogenic noise may be considered as a reduction in the communication space of animals (Clark *et al.* 2009). The frequency range of the potentially masking sound is important in determining any potential behavioral impacts. Because sound generated from in-water pile driving is mostly concentrated at low frequency ranges, it may have less effect on high frequency sounds made by porpoises. The most intense underwater sounds of the proposed Project are those produced by impact pile driving. Given that the energy distribution of pile driving covers a broad frequency spectrum, sound from these sources would likely be within the audible range of marine mammals present in the Action Area.

Impact pile driving activity is relatively short-term. The probability that impact pile driving associated with the proposed Project would result in masking acoustic signals important to the behavior and survival of marine mammal species is low. Vibratory pile driving is also relatively short-term, with rapid oscillations occurring for approximately one and a half hours per pile. It is possible that vibratory pile driving resulting from the Project may mask acoustic signals important to the behavior and survival of marine mammal species, but the short-term duration and limited affected area would result in insignificant impacts from masking. Any masking event that could possibly rise to Level B harassment under the MMPA would occur concurrently within the zones of behavioral harassment already estimated for vibratory and impact pile driving, and which have already been taken into account in the exposure analysis. Therefore, it is unlikely that sounds produced by the pile driving described here would mask marine mammal communications.

7.2 Disturbance Reactions

Responses to continuous sound, such as vibratory pile installation, have not been documented as well as responses to pulsed sounds. With both types of pile driving, it is likely that the onset of pile driving could result in temporary, short term changes in an animal's typical behavior or avoidance of the affected area (Richardson *et al*. 1995). The biological significance of many of these behavioral disturbances is difficult to predict, especially if the detected disturbances appear minor. However, the consequences of behavioral modification could be expected to be biologically significant if the change affects growth, survival, or reproduction.

7.3 Potential Effects on Foraging

The proposed project occurs in an area critically important for foraging pinnipeds during several seasonal runs of anadromous fish. The relationship between sea lions and these ephemeral fish runs is so strong the seasonal abundance and distribution of Steller sea lions throughout Lynn Canal reflects the distribution of spawning herring and pre-spawning/spawning aggregations of eulachon in northern Southeast Alaska, particularly in Lynn Canal (Womble *et al.* 2005). These dense concentrations of quality prey in low-velocity shallow waters make them an easy target for predators such as sea lions and seals (Marston *et al.* 2002). All marine mammals under consideration in this application depend upon this seasonal influx of prey either directly, or indirectly. Transient killer whales occur in the area to forage on pinnipeds aggregated to forage on anadromous fish.

During impact pile driving, elevated levels of underwater noise would ensonify the entire stretch of Lutak Inlet where both fish and mammals occur and could affect foraging success. While these are not permanent impacts, Alaska DOT&PF recognizes that it is important to avoid this period during all in-water construction activities at the Haines Terminal that would raise noise in the inlet above harassment levels. Therefore, pile driving would occur during a three to four hour period following the peak period of fish spawning when marine mammals are no longer entering the inlet to forage on spawning eulachon or herring.

Generally, pinnipeds and whales depart from the area beginning in mid- to late June and move south into lower Lynn Canal and elsewhere in Southeast Alaska to forage. Whale watching vessels and recreational vessels indicate that whales, for the most part, leave by July, and the average density of sea lions decreases steadily to near-zero in mid-late summer.

Alaska DOT&PF would avoid pile driving during the months when ephemeral fish run in the inlet, thereby avoiding the greatest densities of marine mammals in the Action Area, and specifically in the immediate area adjacent to the Haines Ferry Terminal. Therefore, to the greatest extent practicable, impacts from elevated noise levels at the Terminal would be avoided during this period.

7.4 Small Numbers Consideration

Tables 7-1 and 7-2 demonstrate the number of animals potentially exposed to elevated noise levels from the Project that could result in a Level A or Level B take by harassment. The analyses provided in Table 7-1 shows that less than 0.1 percent of total abundance for any stock, species or DPS would be potentially affected by Level A acoustic harassment due to activities at the Terminal.

Also, it is very likely there would be multiple takes of a smaller percentage of individuals. The numbers of animals authorized to be taken for all species would be considered small relative to their stocks or populations even if each estimated taking occurred to a new individual—an extremely unlikely scenario. In all cases, the take request is one percent or less of the estimated size of the stock and, therefore, considered ‘small’ numbers pursuant to NMFS guidance. Further, potential take at these levels would not have any effect on populations, population recruitment or survival, and the effect of such take would be considered insignificant.

Based on this analysis of the likely effects of the specified activity on marine mammals, and taking into consideration the implementation of the mitigation and monitoring measures (see Section 11), only small numbers of marine mammals are likely to be taken relative to the populations of the affected species or stocks.

7.5 Negligible Impact Consideration

Negligible impact is “an impact resulting from the specified activity that cannot be reasonably expected to, and is not reasonably likely to, adversely affect the species or stock through effects on annual rates of recruitment or survival”[17]. A negligible impact finding is based on the lack of likely adverse effects on annual rates of recruitment or survival (i.e., population-level effects). In all cases the requested number of Level A takes are less than one-tenth of 1.0 percent of the estimated abundance for the stock or DPS

[17] Definition at 50 CFR 216.103

(Tables 7-1). Further, Level B takes are neither considered serious or injurious and would not result in mortality. Therefore, the requested levels of both Level A and Level B takes are significantly lower than any such level that would adversely affect a species or stock through recruitment or survival. The results are clearly negligible from a biological perspective.

However, an estimate of the number of Level A or Level B harassment takes alone is generally not enough information on which to base an impact determination. In addition to considering estimates of the number of marine mammals that might be "taken" through behavioral harassment, other factors were considered such as the nature of any responses (their intensity, duration), the context of any responses (critical reproductive time or location, migration, etc.), as well as the number and nature of estimated Level A harassment takes, the number of estimated mortalities, effects on habitat, and the status of the species. This discussion applies to the six species listed in Table 3.1.

Pile driving activities associated with the proposed Project have the potential to temporarily disturb or displace marine mammals. Specifically, the specified activities may result in Level A or Level B harassment (behavioral disturbance) for all species authorized for take, from underwater sound generated from pile driving. Potential takes could occur if individuals of these species are present in the ensonified zone when pile driving is under way.

The takes from Level A harassment would be due to potential behavioral disturbance. While Level A takes have been requested for this project, serious injury, PTS, or death would be extremely unlikely for all authorized species. These potential takes are considered precautionary as they could occur at a considerable distance from the Terminal. The precautionary numbers help to determine the appropriate level of mitigation and monitoring, which would further ensure that a Level A take is avoided. Any pinnipeds potentially exposed to Level A take thresholds would have to be moving in front of the Terminal or transiting to or from foraging in areas that might result in Level B disturbance. Therefore, the exposure would occur in a very short time-frame or the Project activity would be stopped until the animal was safely out of the Level A threshold zone.

The takes from Level B harassment would be due to potential behavioral disturbance and potential TTS. Injury is unlikely for all species exposed, as Alaska DOT&PF would enact several required mitigation measures to prevent animals from entering the Level A serious injury zone. Soft start techniques would be employed during pile-driving operations to allow marine mammals to vacate the area prior to commencement of full power driving (see Section 11 Mitigation). Alaska DOT&PF would establish and monitor shutdown zones for authorized species, which would prevent or significantly reduce the likelihood of injury to these species. Alaska DOT&PF would also record all occurrences of marine mammals and any behavior or behavioral reactions observed, any observed incidents of behavioral harassment, and any required shutdowns, and would submit a report upon completion of the project. Based on experience from 2015, Alaska DOT&PF believes that proposed mitigation measures are sufficient to reduce the effects of the specified activities to the level of effecting the least practicable adverse impact upon the affected species, as required by the MMPA.

The Alaska DOT&PF's proposed activities are localized and of short duration spread out over a 4-month period. The entire Project Area is limited to the Terminal and its immediate surroundings. While impact driving does have the potential to cause injury to marine mammals, mitigation in the form of shutdown zones should eliminate or minimize exposure to Level A thresholds. Vibratory driving does not have significant potential to cause injury to marine mammals due to the relatively low source levels produced and the lack of potentially injurious source characteristics. Additionally, Alaska DOT&PF intends to conduct pile driving during months where marine mammal densities are slightly lower than during peak foraging months, thereby minimizing exposures during pile driving.

Based on current literature as well as monitoring from other similar activities, effects on individuals that are taken by either Level A or Level B harassment would be considered insignificant to minor. Most individuals would simply move through, or away from, the sound source and be temporarily displaced from the areas of pile driving. This reaction has been observed primarily only in association with impact pile driving. In response to vibratory driving, pinnipeds (which may become somewhat habituated to human activity in industrial or urban waterways) have been observed to orient towards and sometimes move towards the sound. The pile-driving activities analyzed here are similar to, or less impactful than, numerous construction activities conducted in similar locations where no serious injuries or mortality to marine mammals, and no known long-term adverse consequences from behavioral harassment were reported. Repeated exposures of individuals to levels of sound that may cause Level B harassment are unlikely to result in hearing impairment or to significantly disrupt foraging behavior. Thus, even repeated Level B harassment of some small subset of the overall stock is unlikely to result in any significant realized decrease in fitness for the affected individuals and would not result in any adverse impact to individuals or the stock.

In summary, the takes requested for this activity would result in no more than a negligible impact to any of the marine mammal species that may be taken during this Project. This is based on: (1) the overall effectiveness of proposed mitigation measures at minimizing the effects of pile driving and associated construction activities; (2) the low probability of serious injury or mortality to species; and (3) the anticipated incidents of Level B harassment likely consisting of, at worst, temporary modifications in behavior. Further, the results of recent studies at similar, adjacent locations demonstrate that the potential effects of the specified activity would have only short-term effects on individuals. The specified activity is not expected to impact rates of recruitment or survival and would therefore not result in population-level impacts.

8. ANTICIPATED IMPACTS ON SUBSISTENCE USE

There would be no impact on subsistence species or on the availability of marine mammals for subsistence purposes due to activities associated with this Project. The proposed Project is within a much larger area where subsistence hunting for harbor seals or sea lions could occur (Wolfe *et al.* 2013); however, subsistence hunting does not occur in the vicinity of the Haines Ferry Terminal due to levels of industrial and shipping activity in the immediate area. The proposed activities at the Project site would have no impact on the abundance or availability of either species to subsistence hunters in the region. There is no hunting in the vicinity of the Project. There are no harvest quotas for non-listed marine mammals found there. The ADF&G (Wolfe *et al.* 2013) has regularly conducted surveys of harbor seal and Steller sea lion subsistence harvest in Alaska and the number of animals taken for subsistence in this immediate area is low when compared to other areas in Southeast Alaska. Since proposed work at the Terminal would only cause temporary disturbance of marine mammals, no impacts are anticipated for either the subsistence species, or any potential harvest of marine mammals in the region.

Subsistence hunting for humpback whales or killer whales does not occur in this region.

9. ANTICIPATED IMPACT ON HABITAT

9.1. Underwater Noise Disturbance

Construction activities at the Haines Ferry terminal could have temporary impacts on marine mammal habitat by increased in-water sound pressure levels from pile driving causing animals to avoid the area during pile installation activities. The primary reason that animals would leave the Project area would be to elevated noise levels. Other potential temporary impacts would be to water quality (increases in turbidity levels), and possibly influencing prey species distribution. Best management practices (BMPs) and minimization practices used by Alaska DOT&PF to minimize potential environmental effects from Project activities would be used throughout this Project and are outlined in Section 11 Mitigation Measures.

Pile driving would expose marine mammals to potential harassment, but in-water noise impacts are localized and of short duration; therefore, any impact on individual cetaceans and pinnipeds would be limited. While it is possible that pinnipeds may avoid the project area during pile driving, they are not likely to abandon the site altogether. Despite background noise levels and facility activities, seals have been seen near the Terminal, and nearby dock facilities often attract pinnipeds due to the availability of prey in the form of discards from commercial and sport fishermen.

9.2. Water and Sediment Quality

In-water pile driving, pile removal, and dredging activities would cause short-term effects on water quality due to increased turbidity. Turbidity plumes created by the activity could last from a few minutes to several hours. Any contaminants associated with the re-suspended sediments would be tightly bound to the sediment matrix. Because of the relatively small dredge area, turbidity plumes would be limited to the immediate vicinity of the Terminal and adjacent portion of the inlet.

There is a potential for pinnipeds to be exposed to increased turbidity during dredge operations. However, exposure to re-suspended contaminants is expected to be minimal since sediments would not be ingested, and contaminants would be tightly bound to them.

Because of the potential contamination and relatively silty nature of sediments in subtidal areas, several turbidity and containment reducing BMPs would be implemented to reduce turbidity plume size and duration. Alaska DOT&PF would comply with the "Alaska Standard Specifications for Highway Construction 2015, Section 641, Erosion, Sediment, and Pollution Control".

BMPs for this purpose are:

- Turbidity and other water quality parameters would be monitored to ensure construction activities are in compliance with ADEC standards;
- Appropriate BMPs would be employed to minimize sediment resuspension, loss, and turbidity generation during dredging;
- Prioritization of removal of the most highly impacted areas first, then moving to less impacted areas, also taking into account phasing for the demolition and construction of new elements to keep the terminal operational during construction;

- No stockpiling of dredged material on the seafloor; and
- No seafloor leveling by dragging the bucket or other device.

Despite these BMPs, turbidity may be increased above background levels within the immediate vicinity of construction activities. Increased turbidity is expected to occur in the immediate vicinity (less than 3.05 m or 10 ft.) of construction activities. Because of local currents and tidal action as well as use of BMPs, any potential water quality exceedances are expected to be temporary and highly localized. The local currents would disperse suspended sediments from pile driving and dredging operations at a moderate to rapid rate depending on tidal stage. Fish and marine mammals in the Lutak Inlet/Lynn Canal region are routinely exposed to substantial levels of suspended sediment from glacial sources.

During dredging, suspension of anoxic sediment may result in reduced dissolved oxygen (DO) in the water column as the sediments oxidize, but any reduction in DO above background is expected to be limited in extent and temporary in nature.

Also, increased turbidity from construction activities has the potential to adversely affect forage fish and juvenile salmonid out-migratory routes in the Project Area. However, suspended sediments and particulates are expected to dissipate quickly within a single tidal cycle. Given the limited area affected and high tidal dilution rates any effects on forage fish and salmon are expected to be minor or negligible. In addition, BMPs would be in effect, which would limit the extent of turbidity to the immediate Project Area. Finally, exposure to these contaminants from dredging is not expected to be different from the current exposure; fish and marine mammals in the Lynn Canal region are routinely exposed to substantial levels of suspended sediment from nearby glacial river sources.

Cetaceans are not expected to be close enough to the Terminal to experience turbidity. Any pinnipeds would be transiting the Terminal area and could avoid localized areas of turbidity. Therefore, the impact from increased turbidity levels is expected to be negligible to marine mammals.

9.3. Passage Obstructions

Pile driving at the Terminal would not obstruct movements of marine mammals. Pile work at the Project site would occur adjacent to the existing site and within 152 m (500 ft.) of the shoreline (see Appendix A for details). A construction barge may be used during the project. The barge would be anchored. In a previous ESA concurrence letter for the Vashon Island Dolphin Replacement Project (NMFS 2008b), in which barge activity was similar to that at Terminal, NMFS stated the following:

> *Vessels associated with any project are primarily tug/barges, which are slow moving, follow a predictable course, do not target whales, and should be easily detected by whales when in transit. Vessel strikes are extremely unlikely and any potential encounters are expected to be sporadic and transitory in nature.*

Similarly, vessel strikes are highly unlikely for the proposed project.

9.4. Construction Effects on Potential Prey

Construction activities would produce continuous (i.e., vibratory pile driving) sounds and pulsed (i.e. impact-driving) sounds. Fish react to sounds that are especially strong and/or intermittent low-frequency sounds. Short duration, sharp sounds can cause overt or subtle changes in fish behavior and local distribution. Popper and Fay (2003) that the process of hearing across fishes is quite variable - from species that only hear up to 100 or 200 kHz to others that hear to well over 180 kHz. Popper and Fay (2009) reported that Atlantic salmon were found to have a sensitivity to acoustic particle motion at frequencies below 200Hz and sound pressure above 200 Hz (Hawkins and Johnstone 1978). Hastings and Popper (2005) identified several studies that suggest fish may relocate to avoid certain areas of sound energy. Additional studies have documented effects of pile driving on fish, although several are based on studies in support of large, multiyear construction projects (Scholik and Yan 2001, 2002; Popper and Hastings 2009).

Generally, the most likely impact to fish from pile-driving activities in the Project Area would be temporary behavioral avoidance of the area. However, even this is unlikely during the pre-spawning movements into the Action Area by eulachon and herring. The duration of fish avoidance of this area after pile driving stops is unknown, but a rapid return to normal recruitment, distribution and behavior is anticipated. In general, impacts to marine mammal prey species are expected to be minor and temporary due to the short timeframe for the project.

Given the area is recognized as being an important foraging area to marine mammals (see Section 7.4), Alaska DOT&PF would avoid pile driving during the months when fishes run in the inlet, thereby avoiding the greatest densities of fish [and marine mammals] in the Action Area, and specifically in the immediate area adjacent to the Haines Ferry Terminal. Therefore, to the greatest extent practicable, impacts from elevated noise levels on available prey would be avoided during this period.

9.5. Construction Effects on Potential Foraging Habitat

Pile installation may temporarily increase turbidity resulting from suspended sediments. Any increases would be temporary, localized, and minimal (see Section 9.2). Alaska DOT&PF must comply with state water quality standards during these operations by limiting the extent of turbidity to the immediate project area. In general, turbidity associated with pile installation is localized to about a 7.6 M (25 ft.) radius around the pile (Everitt *et al.* 1980). Cetaceans are not expected to be close enough to the project pile-driving areas to experience effects of turbidity, and any pinnipeds would be transiting the area and could avoid localized areas of turbidity. Therefore, the impact from increased turbidity levels is expected to be discountable to marine mammals. Furthermore, pile driving and pile removal at the project site would not obstruct movements or migration of marine mammals.

9.6. Conclusions Regarding Impacts on Habitat

The most likely effects on marine mammal habitat from the proposed Project are temporary, short duration noise and water quality effects. The direct loss of habitat available to marine mammals during construction due to noise, water quality impacts and construction activity is expected to be minimal. All cetacean species using habitat near the Terminal would be transiting the area, rather than resident.

Any adverse effects on prey species during project construction would be short term. Given the large numbers of fish and other prey species in Lutak Inlet during mid-March to mid-June, the short-term nature of effects on fish species and the mitigation measures to protect mammals during construction (use of a vibratory hammer when possible, BMPs, restrictions on conducting pile driving to minimize impacts from in-water work during foraging periods), construction actions at the Terminal are not expected to have measurable effects on the distribution or abundance of potential marine mammal prey species.

Passage is not expected to be obstructed as a result of the proposed Project. Any temporary obstruction due to barge placement would be localized and limited in duration, and a traveling barge is too slow to strike marine mammals.

The proposed activities at the Terminal are not likely to result in permanent negative impacts to habitats used directly by marine mammals, but may have potential short-term impacts to food sources such as forage fish and may affect acoustic habitat (see masking discussion above). The Project area is a known seasonal foraging hotspot to marine mammals, especially pinnipeds of significant biological importance. Therefore, the main impact associated with the proposed activity would be temporarily elevated sound levels and the associated direct effects on marine mammals (discussed previously) as well as potential short-term effects to water and sediment quality.

The primary potential acoustic impacts to marine mammal habitat are associated with elevated sound levels produced by impact pile driving in the area. However, other potential impacts to the surrounding habitat from physical disturbance would also be possible. Noise measurements of dredging indicate that the activity is considered to be a low-impact activity for marine mammals, producing non-pulsed sound and being substantially quieter in terms of acoustic energy output than sources such as seismic air guns or impact pile driving. Noise produced by dredging operations has been compared to that produced by a commercial vessel travelling at modest speed (Robinson *et al.* 2011). Generally, the effects of dredging on marine mammals are not expected to rise to the level of a take. However, to further reduce potential acoustic impacts to harbor seals and Steller sea lions, there would be a 200 m (656 ft.) dredging shutdown zone for any marine mammals approaching the dredging operation.

10. ANTICIPATED EFFECTS OF HABITAT IMPACTS ON MARINE MAMMALS

Section 9 discussed the ways the specified activity (e.g. pile driving), associated with the reconstruction of the Terminal may impact marine mammals due to impacts on their habitat. Mitigation measures would reduce impacts to marine mammals from the project activities. Please refer to Section 11, Proposed Mitigation Measures section for more information.

The proposed activities are not likely to result in a significant adverse or permanent loss or modification of habitat for marine mammals or their prey. The most likely effects on marine mammal habitat due to the proposed Project are temporary, short duration in-water noise, temporary prey (fish) disturbance, and localized, temporary water quality effects. The activities may cause some fish to leave the area of disturbance, thus temporarily impacting marine mammals' foraging opportunities in a limited portion of the foraging range; but, because of the short duration of the activities and the relatively small area of the habitat that may be affected, the impacts to marine mammal habitat are not expected to cause significant or long-term negative consequences. These temporary impacts have been discussed in detail in Section 9.0, Anticipated Impact on Habitat. Additionally, no physical damage to habitat is anticipated as a result of Project activities at the Terminal. Therefore, the potential impacts to marine mammal habitat are expected to be minimal to insignificant.

11. MITIGATION MEASURES

Alaska DOT&PF activities are subject to Federal, State and local permit regulations. Alaska DOT&PF has developed and routinely uses the best guidance available (e.g., BMPs and mitigation measures) to avoid and minimize (to the greatest extent possible) impacts on the environment, ESA species, designated critical habitats and species protected under the MMPA.

Although mitigation for noise would occur throughout all pile-driving actions at the Terminal, mitigation measures to reduce total takes (e.g. closures, shutdown periods) would be employed throughout all phases of the construction at the Terminal. General mitigation measures used for all construction practices are listed first (Section 11.1), followed by specific mitigation measures for pile installation activities (Section 11.2).

11.1. General Construction Activities

Alaska DOT&PF performs construction in accordance with the best guidance available (e.g., BMPs and mitigation measures) to avoid and minimize (to the greatest extent possible) impacts on the environment, ESA species, designated critical habitats and species protected under the MMPA. Mitigation measures include:

- The construction contractor would follow the conditions and guidance for Erosion, Sediment, and Pollution Control outlined in Section 641 of the DOT&PF construction specifications (2015);.18
- For equipment noise, Alaska DOT&PF would comply with the requirements of the FHWA Construction Noise Handbook (2005)[19];
- The dock would be maintained in a manner that does not introduce any pollutants or debris into the harbor or cause a migration barrier for fish;
- Fuels, lubricants, and other hazardous substances would not be stored below the ordinary high water mark;
- Properly sized equipment would be used to drive piles;
- Oil booms would be readily available for containment should any releases occur;
- The contractor would check for leaks regularly on any equipment, hoses, and fuel storage that occur at the project site;
- All chemicals and petroleum products would be properly stored to prevent spills; and
- No petroleum products, cement, chemicals, or other deleterious materials would be allowed to enter surface waters.

[18] http://www.dot.alaska.gov/stwddes/dcsspecs/assets/pdf/hwyspecs/sshc2015.pdf
[19] http://www.fhwa.dot.gov/environment/noise/construction_noise/handbook/

11.2. Pile Installation Activities

The following subsections describe mitigation measures proposed by Alaska DOT&PF during pile-driving activities. These measures would reduce impacts on marine mammals to the lowest extent practicable throughout the duration of the IHA.

11.2.1. Marine Mammal Monitoring

Marine mammal monitoring would be employed during all pile-driving activities. Current NMFS guidelines recommend that noise-producing activities should be shut down prior to reaching the PTS threshold (NMFS 2016).

A primary MMO would be placed at a vantage point (e.g., at Tanani Point, Figure 11-1) that allows monitoring of the area offshore from the Terminal and across the inlet, a width of about 0.6 miles (1 km). The area potentially ensonified above Level A thresholds during pile driving is large. The $R_{95\%}$ range to the onset of Level A exposure during pile driving (2 piles) of 36-in. diameter piles is approximately to 2 km (1.25 miles) for LFCs (i.e. humpback whales) and also 1.5 km (1 mile) for HFCs (i.e., harbor porpoise) (see Table 6-6). However, the configuration of the coastline across from the Haines Terminal truncates the maximum distance Level A sound would travel. By placing a primary MMO approximately 1 mile downshore from the noise source, the maximum distance (for harbor porpoise) required to observe the Level A ensonified zone would be reduced to less than 1 mile in any direction, Therefore, the area of water ensonified at or above Level A threshold zones for all cetaceans and pinnipeds could be visually monitored by the primary MMO.

If a humpback whale or harbor porpoise is observed approaching these ZOEs during pile driving, the animal would be carefully monitored at that point. If an animal enters a zone where noise levels exceed the threshold for Level A, it would be monitored for a period not to exceed one hour. During this monitoring period, if the animal approaches closer than the outside of the Level A ZOE, then all pile driving or removal activities would be halted to minimize potential impact. If the animal stays inside the Level A zone, does not approach closer, and then leaves the ZOE within the one-hour period, pile driving activities would not be stopped. The animal would be recorded as a Level A take and its behavior would be reported. Any marine mammal observed approaching their respective Level A zone would have already been exposed to Level B thresholds and would be recorded as a Level B take, and animal behaviors would be documented.

Alaska DOT&PF recognizes that pile driving activities would be shut down if an animal is observed inside the Level A harassment zone for one hour, or if an animal is observed inside the Level A ZOE and is approaching the noise source. These animals would be considered Level A takes and are reflected in the take requests in Table 6-14. From the Terminal site, the secondary MMO would also shut down operations if any pinnipeds are observed approaching 0.33 km (1083 ft) of the Project site. This would result in in only Level B takes during impact pile driving for both sea lions and harbor seals (Table 11-1).

TABLE 11-1 MODELED EXPOSURE LEVELS AT A DISTANCE OF 0.48 KM (0.3 MILES [500 M]) FROM THE TERMINAL

	24-hr SEL @ 500m (dB re 1µPa²s) Impact	Vibratory
30-in. pile		
HFC	128.6	74.0
MFC	132.8	80.4
LFC	157.9	139.8
OPW	149.4	98.4
PPW	149.2	121.0
36-in. pile		
HFC	130.7	73.8
MFC	135.0	81.7
LFC	159.5	142.1
OPW	151.4	100.3
PPW	151.2	123.2

11.2.2. Soft Start

To minimize disturbance and harm to marine mammals from pile driving noise, ADOT&PF would implement a "soft-start" procedure to allow animals to leave the area prior to full sound exposure. Specifically, ADOT&PF would use the soft-start technique at the beginning of impact pile driving each day, or if pile driving has ceased for more than 30 minutes. Soft-start procedures would be used prior to impact pile removal or pile installation to allow marine mammals to leave the area prior to exposure to maximum noise levels. The requirements for soft start for impact driving are:

> *Initiating sound from impact driving with an initial set of three strikes from the impact hammer at reduced energy, followed by a 1-minute waiting period, then two subsequent three strike sets. Soft start will be required at the beginning of each day's impact pile driving work and at any time following a cessation of pile driving of 30 minutes or longer*.

11.2.3. Pile Driving Timing

As stated in Sections 3 and 4, the abundance of marine mammals in the Action Area correlates with the seasonal influx of forage fish in spring and late fall-winter. This is especially true for pinnipeds but also for cetaceans that prey on the forage fish species, or in the case of killer whales prey on the pinnipeds aggregated in the Action Area. Alaska DOT&PF has determined that the best way to mitigate or reduce Level A and Level B takes is to avoid activities that result in increased noise and potential disturbance to marine mammals, and their prey base, during these critically important feeding periods. Based on projected take estimates by month the best window for construction begins in mid- to late-June when animals are leaving the area, through September, prior to their return to forage on salmon in adjacent streams. Therefore, all pile driving activities would occur during this period when the likelihood for Level A and Level B takes to occur is at a minimum.

11.3. Mitigation Summary

Alaska DOT&PF has developed the proposed mitigation measures to ensure the least practicable impact on affected marine mammal species and stocks and their habitat. The potential measures include consideration of the following factors in relation to one another: (1) the degree to which, the successful implementation of the measure is expected to minimize adverse impacts to marine mammals; (2) the proven efficacy of the specific measure to minimize adverse impacts as planned based on monitoring plans from previous, similar IHA applications incorporating pile driving; and (3) the practicability of the measure for implementation. Based on these factors Alaska DOT&PF believes the mitigation measures being considered accomplish the required objectives:

- Avoidance or minimization of injury or death of marine mammals;
- Avoidance of pile driving activities at biologically important times for marine mammals at the Project site to reduce the total number of marine mammals potentially exposed to harassment from pile driving;
- Avoidance of peak, biologically significant foraging periods for pinnipeds and cetaceans in the Action Area to reduce impacts to forage species as well as marine mammals, paying particular attention to the prey-base seasonal cycles, activities that block or limit passage to or from biologically important areas, permanent destruction of habitat, or temporary destruction/disturbance of habitat during the biologically important foraging season in spring.

Based on results of previous monitoring programs similar to the Project at the Terminal (MOS 2016, UMCD 2016), the proposed mitigation measures provided would ensure the least practicable impact on marine mammals species or stocks and their habitat.

12. MEASURES TO REDUCE IMPACTS TO SUBSISTENCE

It is highly unlikely that there would be any impact to subsistence species or on the availability of marine mammals for subsistence purposes due to this Project. Even though subsistence hunting does occur in the larger Upper Lynn Canal area, the area around the Haines Ferry Terminal is not used for subsistence hunting due to levels of industrial and shipping activity. Alaska DOT&PF has already notified local Alaska Native tribes that may hunt marine mammals for subsistence in the larger Upper Lynn Canal region. Of the marine mammals considered in this IHA application, only harbor seals and Steller sea lions are used for subsistence.

Therefore, the proposed activities at the Project site would have no impact on the abundance or availability of either species to subsistence hunters in the region, and no further measures to reduce impacts to subsistence are being considered.

13. MONITORING AND REPORTING

In order to issue an IHA for an activity, section 101(a)(5)(D) of the MMPA states that NMFS must set forth “requirements pertaining to the monitoring and reporting of such taking.” The MMPA implementing regulations at 50 CFR 216.104 (a)(13) indicate that requests for incidental take authorizations must include the suggested means of accomplishing the necessary monitoring and reporting that would result in increased knowledge of the species and of the level of taking or impacts on populations of marine mammals that are expected to be present in the proposed Action Area.

Alaska DOT&PF recognizes that monitoring requirements should be designed that improve the understanding of one or more of the following:

- Occurrence of marine mammal species in the Action Area (e.g., presence, abundance, distribution, density);
- Nature, scope, or context of likely marine mammal exposure to potential stressors/impacts (individual or cumulative, acute or chronic), through better understanding of: (1) Action or environment (e.g., source characterization, propagation, ambient noise); (2) Affected species (e.g., life history, dive patterns); (3) Co-occurrence of marine mammal species with the action; or (4) Biological or behavioral context of exposure (e.g., age, calving or feeding areas);
- Individual responses to acute stressors, or impacts of chronic exposures (behavioral or physiological);
- How anticipated responses to stressors impact either: (1) Long-term fitness and survival of an individual; or (2) Population, species, or stock;
- Effects on marine mammal habitat and resultant impacts to marine mammals; and
- Mitigation and monitoring effectiveness.

13.1. Visual Marine Mammal Observations and Monitoring

Alaska DOT&PF would collect observation data and behavioral responses to construction for marine mammal species observed in the region of activity during the period of activity. All marine mammal observers (MMOs or observers) would be trained in marine mammal identification and behaviors and are required to have no other Project-related tasks while conducting monitoring. The Primary Observer would monitor the Level A harassment zone for LFCs and HFCs before, during, and after pile driving as described in detail in Section 11.2.1.

As a precautionary measure, Alaska DOT&PF has requested the number of Level A takes (Table 6-14) determined to be necessary based on modeling calculations for this specific Project, not taking into account MMO monitoring and shut down measures as a primary source of mitigation for this project.

Alaska DOT&PF would implement the following monitoring procedures during pile driving:

- MMOs would be on site before, during and after all pile driving activities and would monitor Level A, and Level B harassment ZOEs.

- If a humpback whale or harbor porpoise, or any other marine mammal, is observed approaching these ZOEs during pile driving, the animal would be monitored carefully at that point. If an animal enters a zone where noise levels exceed the threshold for Level A, it would be monitored for a period not to exceed one hour. During this monitoring period, if the animal approaches closer than the outside of the Level A ZOE, then all pile driving or removal activities would be halted to minimize potential impact. If the animal stays inside the Level A zone, does not approach closer, and then leaves the ZOE within the one-hour period, pile driving activities would not be stopped. The animal would be recorded as a Level A take and behavior would be reported. Any marine mammal observed approaching their respective Level A zone would have already been exposed to Level B thresholds and would be recorded as a Level B take, and animal behaviors would be documented.
- The MMOs would be authorized to shut down activity if necessary. If pile driving is stopped, pile installation would not commence or would be suspended temporarily if any marine mammals are observed anywhere within the Level A harassment zone.
- An MMO would be placed both at Tenani Point and at the Terminal to monitor all marine mammal behavior and record Level A and Level B takes to the maximum extent practicable.
- MMOs would scan the waters using binoculars, and/or spotting scopes, and would use a hand-held GPS or range-finder device to verify the distance to each sighting from the Project site.
- If poor environmental conditions restrict visibility,(e.g. excessive wind or fog, high Beaufort state), pile installation would cease[20].
- Pile driving activities would only be conducted during daylight hours when it is possible to visually monitor marine mammals.
- If marine mammals are observed within the monitoring zone, the sighting would be documented as either a Level A or Level B take, as appropriate. If the number of marine mammals exposed to Level B harassment approaches the number of takes allowed by the IHA, the Alaska DOT&PF would notify NMFS and seek further consultation.
- Any marine mammal documented within the Level B harassment zone during pile driving would constitute a Level B take, and would be recorded and reported. It is unlikely that all Level B takes can be mitigated due to the size of the ensonified areas. Therefore, Alaska DOT&PF is requesting Level B takes as shown in Table 6-14;
- If any marine mammal species are encountered that are not authorized by the IHA and are likely to be exposed to sound pressure levels greater than or equal to the Level B harassment thresholds, then the Alaska DOT&PF would shut down in-water activity to avoid take of those species.
- The waters would be scanned 15 minutes prior to commencing pile driving at the beginning of each day, and prior to commencing pile driving after any stoppage of 30 minutes or greater. If marine mammals enter or are observed within the designated marine mammal shutdown zone

[20]Alaska DOT&PF considered placing an observer in a vessel located at the boundary between Level A and Level B thresholds, approximately 2.04 km from the Terminal. However, the waters of Chilkoot Inlet can get very rough very quickly. It was deemed unsafe to consider this option further for mitigation and monitoring technique.

during or 15 minutes prior to pile driving, the monitors would notify the on-site construction manager to not begin until the animal has moved outside the designated radius;

- A shutdown zone would be cleared when a marine mammal has not been observed within the zone for a 30-minute period. If a marine mammal is observed within the shutdown zone, a soft-start (described in Section 11.2.5) cannot proceed until the marine mammal has left the zone or has not been observed for 15 minutes (for pinnipeds) and 30 minutes (for cetaceans);
- The waters would continue to be scanned for at least 30 minutes after pile driving has completed each day, and after each stoppage of 30 minutes or greater; and
- In the unanticipated event that the specified activity clearly causes the take of a marine mammal in a manner prohibited by the IHA, such as serious injury or mortality (e.g., ship-strike), the MMO would immediately cease the specified activities and immediately report the incident to the Chief of the Permits and Conservation Division, Office of Protected Resources, NMFS.

13.2. Data Collection

Alaska DOT&PF would require that observers use approved data forms developed for this Project. Among other pieces of information, the observers would record detailed information about any implementation of shutdowns, including the distance of animals to the pile and description of specific actions that ensued and resulting behavior of the animal, if any. In addition, the observers would attempt to distinguish between the number of individual animals taken and the number of incidents of take. At a minimum, the following information would be collected on the observer forms:

1. Date and time that monitored activity begins or ends;
2. Construction activities occurring during each observation period;
3. Weather parameters (e.g., percent cover, visibility);
4. Water conditions (e.g., sea state, tide state);
5. Species, numbers, and, if possible, sex and age class of marine mammals;
6. Description of any marine mammal behavior patterns, including bearing and direction of travel and distance from pile driving activity;
7. Distance from pile driving activities to marine mammals and distance from the marine mammals to the observation point;
8. Description of implementation of mitigation measures (e.g., shutdown or delay);
9. Locations of all marine mammal observations; and
10. Other human activity in the area.

13.3. Reporting

A draft report would be submitted to NMFS within 90 days of the completion of marine mammal monitoring, or 60 days prior to the requested date of issuance of any future IHAs for projects at the same location, whichever comes first. The report would include marine mammal observations pre-activity, during-activity, and post-activity during pile driving days, and would also provide descriptions of any behavioral responses to construction activities by marine mammals. It would include a complete description of all work shutdowns and an extrapolated total take estimate based on the number of marine mammals observed during the course of construction. A final report must be submitted within 30 days following resolution of comments on the draft report.

The report would include the following information 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:
    - Description of the pile driving activity being conducted (pile locations, pile size and type), and times (onset and completion) when pile driving occurs.
    - The construction contractor and/or marine mammal monitoring staff would coordinate to ensure that pile driving times and strike counts are accurately recorded. The duration of soft start procedures should be noted as separate from the full power driving duration.
    - Description of in-water construction activity not involving pile driving (location, type of activity, onset and completion times).
- Pre-activity observational survey-specific data:
    - Date and time survey is initiated and terminated
    - Description of any observable marine mammals and their behavior in the immediate area during monitoring
    - Times when pile driving or other in-water construction is delayed due to presence of marine mammals within shutdown zones.
- Unanticipated Event such as a Serious Injury or Mortality
- Time, date and location of the incident;
- Name and type of vessel involved;
- Vessel's speed during and leading up to the incident;
- Description of the incident;
- Status of all sound source use in the 24 hours preceding the incident;
- Water depth;
- Environmental conditions (e.g., wind speed and direction, Beaufort sea state, cloud cover, and visibility);
- Description of all marine mammal observations in the 24 hours preceding the incident;
- Species identification or description of the animal(s) involved;

- Fate of the animal(s); and
- Photographs or video footage of the animal(s) (if equipment is available).

Activities would not resume until NMFS is able to review the circumstances of the prohibited take. NMFS would work with the MMOs to determine actions necessary to minimize the likelihood of further prohibited take and ensure MMPA compliance. The observers would not be able to resume activities until notified by NMFS via letter, email, or telephone.

In the event that the MMO discovers an injured or dead marine mammal, and the cause of the injury or death is unknown and the death is relatively recent (i.e., in less than a moderate state of decomposition), the MMO would immediately report the incident to the Chief of the Permits and Conservation Division, Office of Protected Resources, NMFS, and the Alaska Stranding Coordinator. Juneau, Alaska.

The report would include the same information identified in the paragraph above. Activities would be able to continue while NMFS reviews the circumstances of the incident. NMFS would work with the observer to determine whether modifications in the activities are appropriate.

In the event that the MMO discovers an injured or dead marine mammal, and 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, or scavenger damage), would report the incident to the Chief of the Permits and Conservation Division, Office of Protected Resources, NMFS, or by email to the Alaska Stranding Coordinator, within 24 hours of the discovery. The MMO would provide photographs or video footage (if available) or other documentation of the stranded animal sighting to NMFS and the Marine Mammal Stranding Network.

14. SUGGESTED MEANS OF COORDINATION

Project activities would be conducted in accordance with all federal, state, and local regulations. This would minimize the likelihood that impacts could occur to the species, stocks, and subsistence use of marine mammals in Upper Lynn Canal. Alaska DOT&PF would continue to cooperate with NMFS and other appropriate federal agencies (USACE, FHWA), and the State of Alaska throughout all phases of the Project.

Alaska DOT&PF would also cooperate with any other marine mammal monitoring and research programs that may take place in the Upper Lynn Canal area during construction of the Terminal. If requested Alaska DOT&PF would provide to other researchers any marine mammals monitoring data and behavioral observations collected during construction of the Terminal. Results of monitoring efforts would be provided to NMFS in a draft summary report within 90 calendar days of the conclusion of monitoring (See Section13). This information could be made available to regional, state, and federal resource agencies, universities, and other interested private parties upon written request to NMFS.

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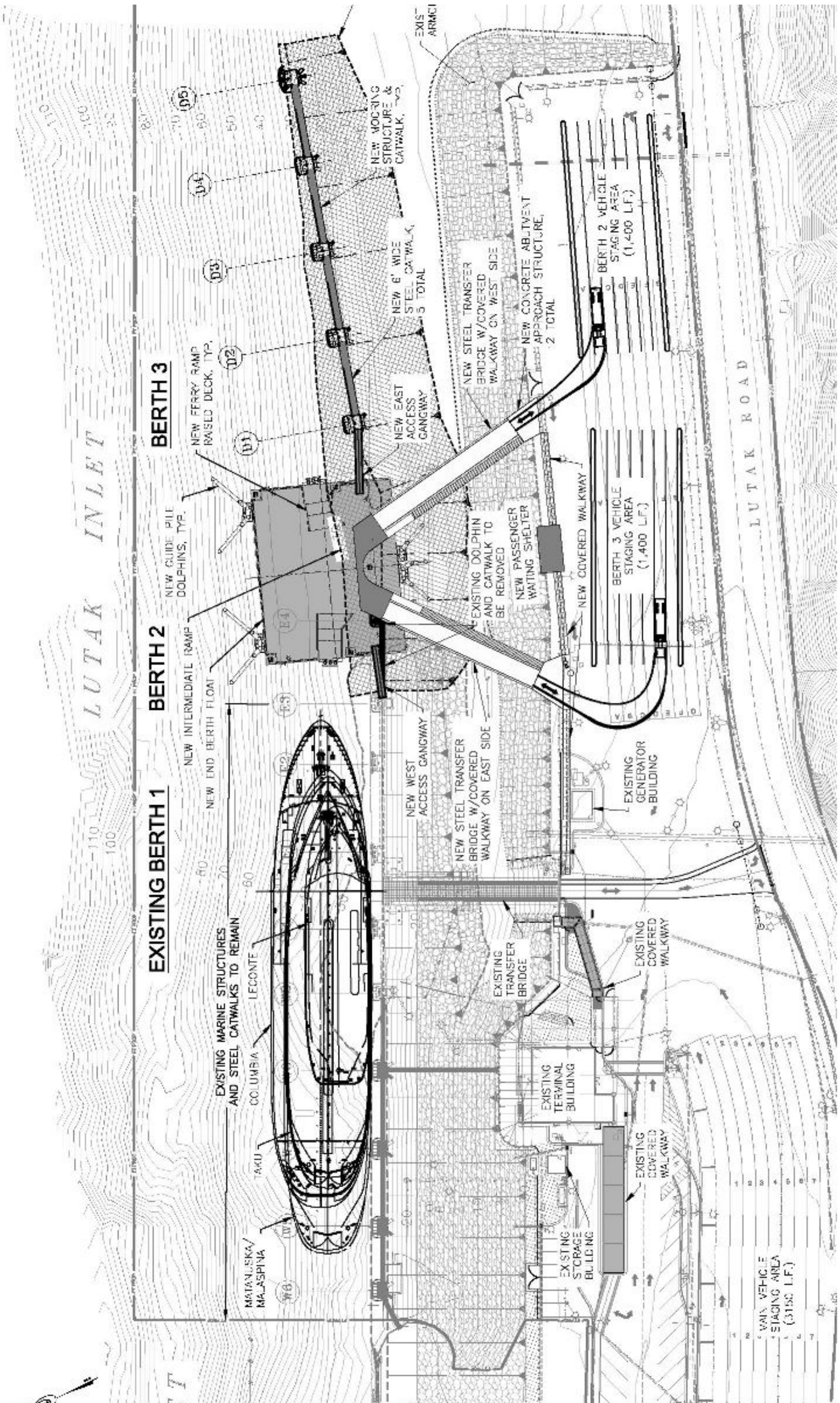
Appendix A

Preliminary Project Description for the AKDOT-AMHS

Haines Ferry Terminal Project Z684640000

Preliminary Project Description for Incidental Harassment Authorization Pre-Application Meeting for the AKDOT-AMHS Haines Ferry Terminal Project #Z684640000



Prepared For:
Alaska Department of Transportation and Public Facilities

Submitted to:
National Marine Fisheries Service
Office of Protected Resources
Silver Spring, Maryland
&
National Marine Fisheries Service
Protected Resources Division
Alaska Region
Juneau, Alaska

Prepared by:
Michael Baker International
3600 C Street, Suite 900
Anchorage, Alaska 99503

9/7/2016

Contents

Tables

Figures

Attachments

Attachment 1. AHMS Haines Ferry Terminal End Berth Facility Haines, Alaska (18 sheets)

1.0 DESCRIPTION OF PROJECT

1.1 DESCRIPTION OF ACTIVITY

The Alaska DOT&PF, in cooperation with the Alaska Division of the Federal Highway Administration (FHWA) is proposing to construct an Alaska Marine Highway System (AMHS) End Berth Facility at the Haines Ferry Terminal, in Haines, Alaska (Haines Ferry Terminal Modification). The re-configuration of the AMHS ferry terminal at Haines is necessary because their current configuration does not allow for operation of the new Alaska Class vessels, which are expected to be operational in 2018.

- The proposed Project will occur in marine waters that support several marine mammal species (Table 1).
- The Project's timing and specific types of activities (such as pile driving) may result in the incidental taking by acoustical harassment (Level B take) of marine mammals protected under the MMPA.
- The construction may result in the need to apply for Level-A takes of several marine mammal species. We will calculate densities and likelihood of exposure before making that determination.
- The Project is planned to be completed within a 12-month period of time.

Therefore, Alaska DOT&PF is applying for an IHA, pursuant to Section 101(a)(5)(D) of the MMPA, 16 USC Section 1371.101 (a)(5), and 50 CFR Section 216, Subpart I, for incidental take by Level B acoustic harassment of five, possibly up to seven species of marine mammals. An IHA application will be submitted in October 2016. Following a review of marine mammal density data and acoustic zones for Level A and Level B, and apply mitigation to reduce or eliminate Level A takes, we will determine whether there is a possible need to apply for Level A take of harbor seals and Steller sea lions.

1.2 DESCRIPTION OF ACTION AREA

The Action Area is defined as the area within which all direct and indirect effects of the Project will occur.

- The Haines Ferry Terminal (Lutak Dock) is located near the mouth of Lutak Inlet, approximately 3 miles north of the town of Haines, in northern Southeast Alaska, at 59°16'54.?''N, 135°27'44.6"W (see Attachment 1 for drawings of the Ferry Terminal End Berth Facility).
- The Action Area extends out to a point where no measurable effects from the Project are expected to occur including the distance where marine mammals are no longer affected by the underwater and in-air sounds produced by Project activities that might result in 'takes' (behavioral disturbance or harassment) to marine mammals.

This is consistent with requirements in the MMPA and with NMFS acoustic injury guidelines that need to be incorporated into any new application[1].

[1] http://www.nmfs.noaa.gov/pr/acoustics/guidelines.htm

1.3 PROJECT ACTIVITIES THAT MAY RESULT IN THE INCIDENTAL TAKE OF MARINE MAMMALS

The project includes the following improvements:

- Remove existing 4-pile structure
- Dredge to -30 MLLW and place slope protection at new berths
- Install the following:
  - concrete mooring and vehicle transfer float
  - (2) 4-pile and (1) 7-pile float restraint structures
  - (2) steel transfer bridges and associated abutment and bearing structure
  - (4) 4-pile mooring and berthing structures
  - (1) 6-pile mooring and berthing structure
  - personnel access catwalks and gangways

The project also includes a pile supported passenger waiting shelter, electrical components for marine and uplands, and paving and striping the staging areas.

In water piling count:

(15) 36” diameter x 1” wall piles

(22) 30” diameter x 3/4” wall piles

2.0 PILE DRIVING AND WATERBORNE NOISE

The proposed Project has two elements involving noise production that may impact marine mammals: vibratory pile driving/pile removal and impact pile driving. Each of these elements generates in-water and in-air noise.

To minimize noise propagation:

- Steel piles will be driven with a vibratory hammer, as practicable;
- In the event that the vibratory hammer is not able to advance the pile an impact hammer with built-in sound attenuation cushions (pile cushions) will be used; and
- Ramp-up procedures for impact pile driving will be implemented. For impact pile driving, an initial set of three strikes from the hammer will be initiated followed by a 30-second waiting period, then two subsequent three-strike sets.

3.0 MARINE MAMMALS

Table 1. Marine mammal species that may occur in project area.

Common Name	Scientific Name	Stock Abundance Estimate[1]	Frequency of Occurrence
Harbor seal	*Phoca vitulina*	9,478	Likely
Steller sea lion	*Eumetopias jubatus*	49,497 (western DPS) 60,131 (eastern DPS)	Likely
Harbor porpoise	*Phocoena phocoena*	11,146	Infrequent
Humpback whale	*Megaptera novaeangliae*	10,252	Infrequent
Killer whale	*Orcinus orca*	2,347 (Alaska residents) 261 (Northern residents) 587 (Gulf, Aleutian, Bering transients) 243 (West Coast transients)	Infrequent
Dall's porpoise	*Phocoenoides dalli*	Unknown	Rare
Minke whale	*Balaenoptera acutorostra*	Unknown	Rare

[1] NMFS marine mammal stock assessment from Muto et al. (2015). Numbers of animals in Action Area less than stock assessment, often significantly less.

4.0 NOISE MODELLING AND TAKE ESTIMATION

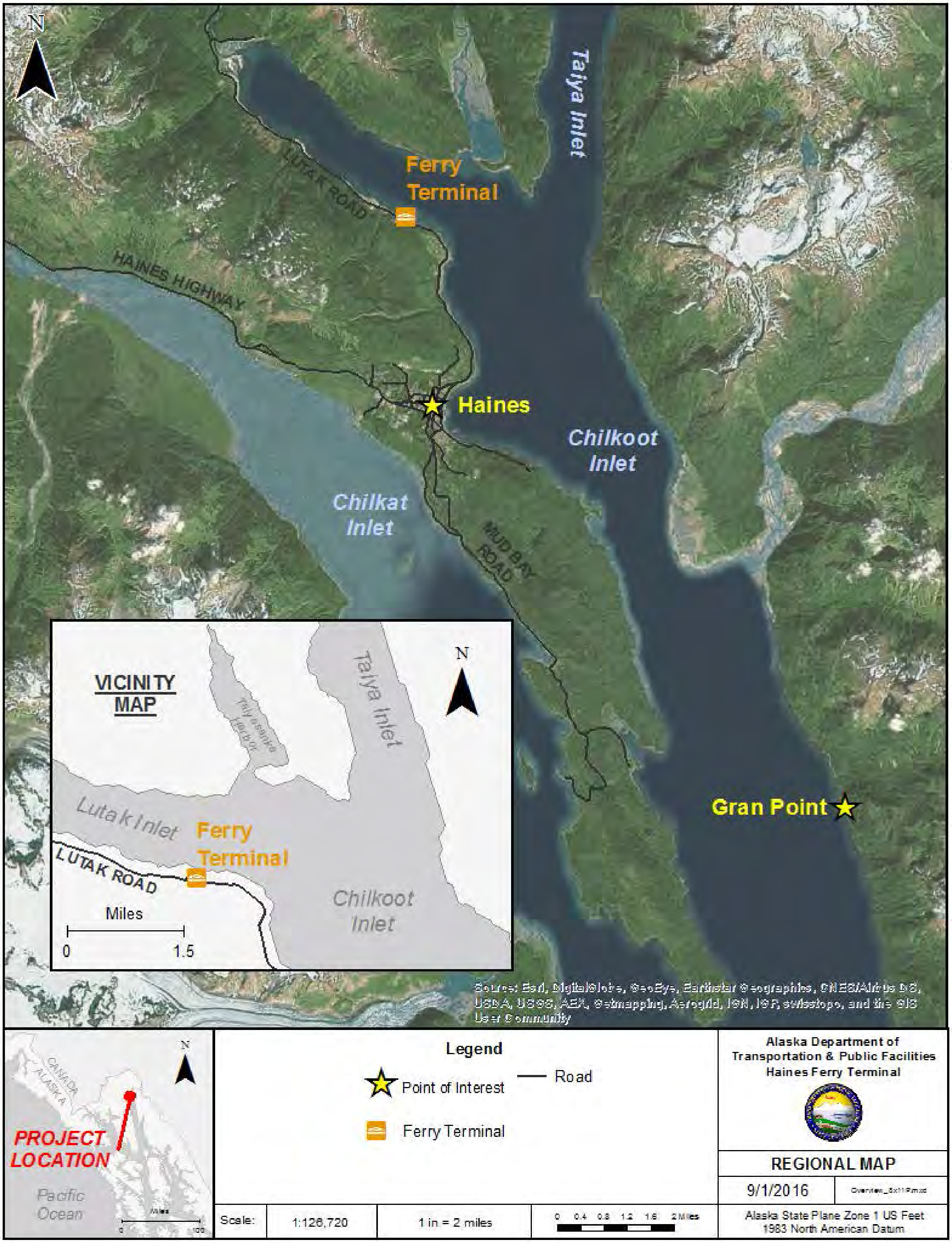
Alaska DOT&PF will calculate safety zones/Zones of Exclusion (ZOE) to ensure that noise-generating activities are shut down before the potential onset of Permanent Threshold Shift (PTS) which occurs at a noise level lower than that which would result in injury (Level A)(consistent with current NMFS guidelines). For example:

- Level B exposure estimate = N (number or density of animals)* Ensonified area * Number of days of noise generating activities.

5.0 QUESTIONS FOR NMFS REGARDING SOUND SOURCE VERIFICATION MODELING

- Can we use sound source verification (SSV) modeling information from a site nearby in Alaska for this project if it is from a site that is not Haines?
- If not, what site should be used as the basis for SSV modeling?

Figure 1. Overview map of Haines Ferry Terminal Modification project.



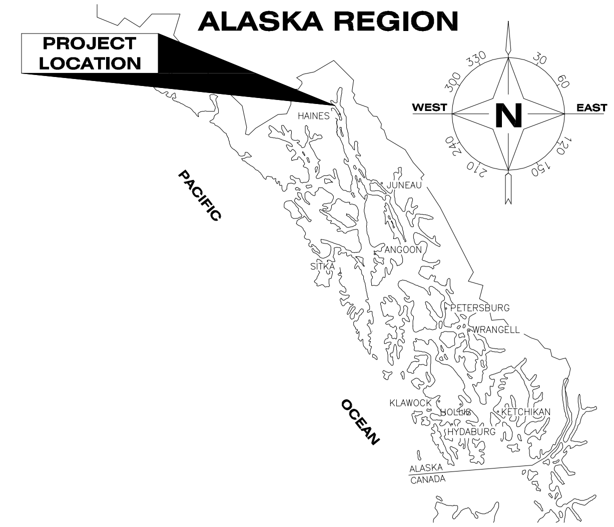
Attachment 1
AHMS Haines Ferry Terminal End Berth Facility
Drawings (18 sheets)

State of Alaska

Department of Transportation and Public Facilities
Southcoast Region

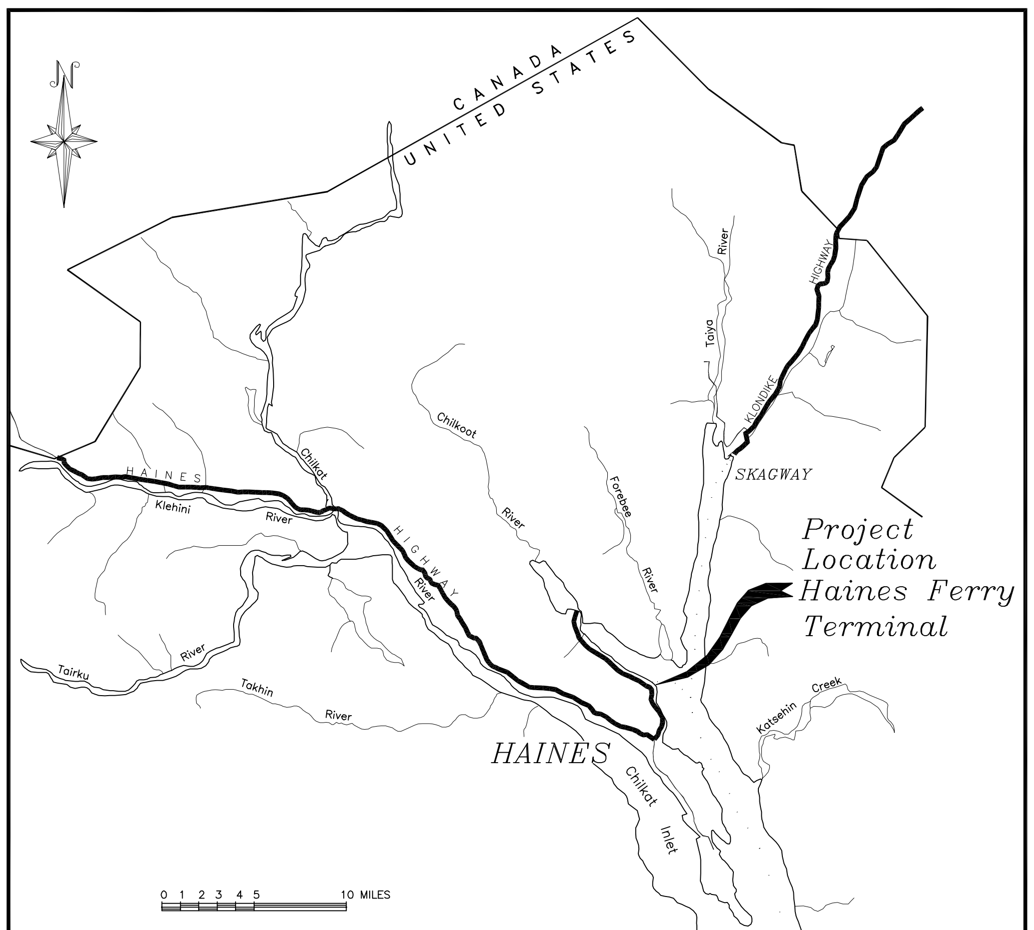
AHMS HAINES FERRY TERMINAL
END BERTH FACILITY
HAINES, ALASKA

PROJECT DESIGNATION Z684640000/0955017



LOCATION MAP

TIDAL DATA	
EHW	+22.5'
HTL	+21.2'
MHW	+15.8'
MLLW	0.0'
ELW	-6.0'



VICINITY MAP

EXISTING TERMINAL SITE

SHEET INDEX

SHEET NO.	DESCRIPTION
01	COVER SHEET
02	EXISTING SITE PLAN
03	SITE PLAN
04	DREDGE PLAN
05	GENERAL ARRANGEMENT PLAN – ALASKA CLASS FERRY (ACF)
06	GENERAL ARRANGEMENT PLAN – SIDE BERTH VESSELS
07	FLOAT PLAN, ELEVATION AND SECTIONS
08	CONCRETE FLOAT PLAN AND SECTIONS
09	STEEL FLOAT PLAN AND SECTIONS
10	TYPICAL GUIDE PILE DOLPHIN
11	SOUTH GUIDE PILE DOLPHIN
12	TRANSFER BRIDGE HIGH TIDE AND LOW TIDE
13	4-PILE MOORING AND BERTHING DOLPHIN
14	6-PILE MOORING AND BERTHING DOLPHIN
15	TYPICAL CATWALK PLAN AND SECTION
16	PASSENGER WAITING SHELTER MODEL VIEWS
17	PASSENGER WAITING SHELTER FLOOR AND ROOF PLANS
18	PASSENGER WAITING SHELTER ELEVATIONS

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STATE OF ALASKA
DEPARTMENT OF TRANSPORTATION & PUBLIC FACILITIES
SOUTHCOAST REGION

APPROVED:

REGIONAL PRE-CONSTRUCTION ENGINEER DATE
L. PAT CARROLL, P.E.

APPROVED:

DIRECTOR, SOUTHCOAST REGION DATE
MIKE COFFEY

CERTIFIED TRUE & CORRECT AS-BUILT OF ACTUAL FIELD CONDITION:

CONSTRUCTION PROJECT MANAGER DATE

STATE	PROJECT DESIGNATION	YEAR	SHEET NO.	TOTAL SHEETS
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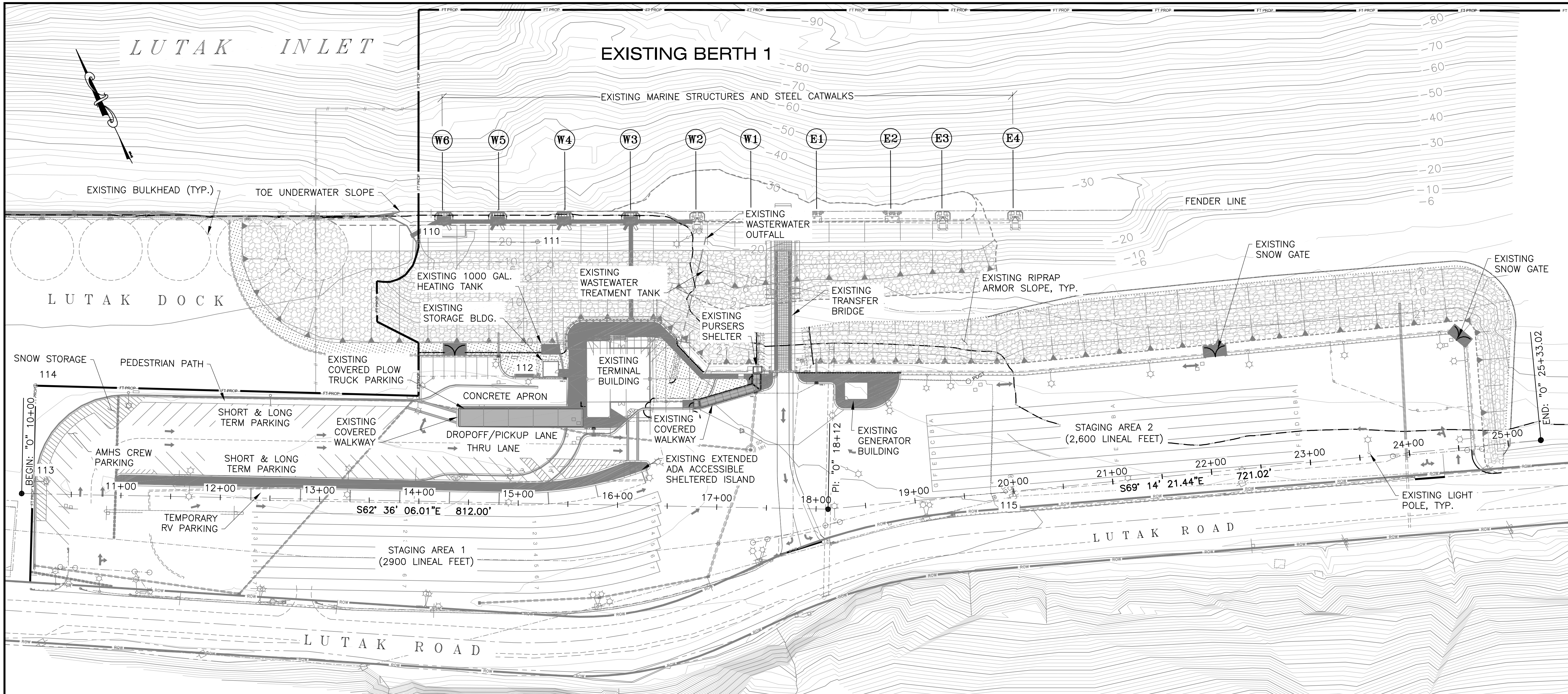

EXISTING SITE PLAN

50' 0 50' 100'
GRAPHIC SCALE (FT)
1" = 50'

LEGEND

- FT PROP — PROPOSED PROPERTY BOUNDARY
- ROW — RIGHT OF WAY LINE
- PROPERTY EASEMENT
- EXISTING ARMOR ROCK

"O" LINE ALIGNMENT TABLE

	POINT DATA			TANGENT DATA	
DESC	STATION	NORTHING	EASTING	BEARING	DISTANCE
BEGIN	10+00	32885.26	50832.39	S 62°36'06.01" E	812.00
PI	18+12.00	32511.59	51553.31	S 69°14'21.44" E	721.02
END	25+33.02	32256.02	52227.52		

RECOVERED MONUMENT TABLE

POINT #	NORTHING	EASTING	DESCRIPTION
110	32935.6848'	51302.7786'	3¼" ALCAP TR-A, C3 TR C, C6 TR E
111	32882.4693'	51410.2984'	3¼" ALCAP C4-TR-C, C5 TR E, ATS 1464
112	32761.4772'	51350.3927'	3¼" ALCAP C1 TR C, C4 TR E, ATS 1464
113	32892.4390'	50848.6556'	3¼" ALCAP C6 TR A, C2 TR B, ATS 1464
114	32976.3653'	50893.0335'	3¼" ALCAP C5 TR A, C3 TR B, ATS 1464
115	32448.0721'	51708.7338'	3¼" ALCAP RM-20, ATS 1464

HORIZONTAL CONTROL

HORIZONTAL CONTROL IS A LOCAL SYSTEM. THE BASIS OF BEARING FOR THIS PROJECT IS THE OBSERVED BEARING BETWEEN STATE HIGHWAY MONUMENT 122 AND STATE HIGHWAY MONUMENT 121, BEING SOUTH 64°59'17" EAST.

VERTICAL CONTROL

DATUM IS MLLW BASED ON STATIC GPS TIES TO NOAA BENCHMARKS 2434 A & B LOCATED IN TIAYASANKA HARBOR. STATIC TIES REFER TO POINT NO. 19, HNS-5, A 3¼" ALUMINUM CAP FOR ATS-1464 LOCATED IN A MONUMENT WITHIN THE FERRY TERMINAL PARKING LOT. MLLW ELEVATION FOR HNS-5 IS 33.99'

DRAWING SCALES ARE FOR FULL-SIZE SHEETS. IF NO SCALE SHOWN, USE DIMENSIONS.

DESIGNED BY: V. PHAN
CHECKED BY: D. PLAYTER
DRAWN BY: T. CHANCELLOR

STATE OF ALASKA
DEPARTMENT OF TRANSPORTATION & PUBLIC FACILITIES
SOUTHCOAST REGION

AHMS HAINES FERRY TERMINAL
END BERTH FACILITY

EXISTING SITE PLAN

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REVISIONS		
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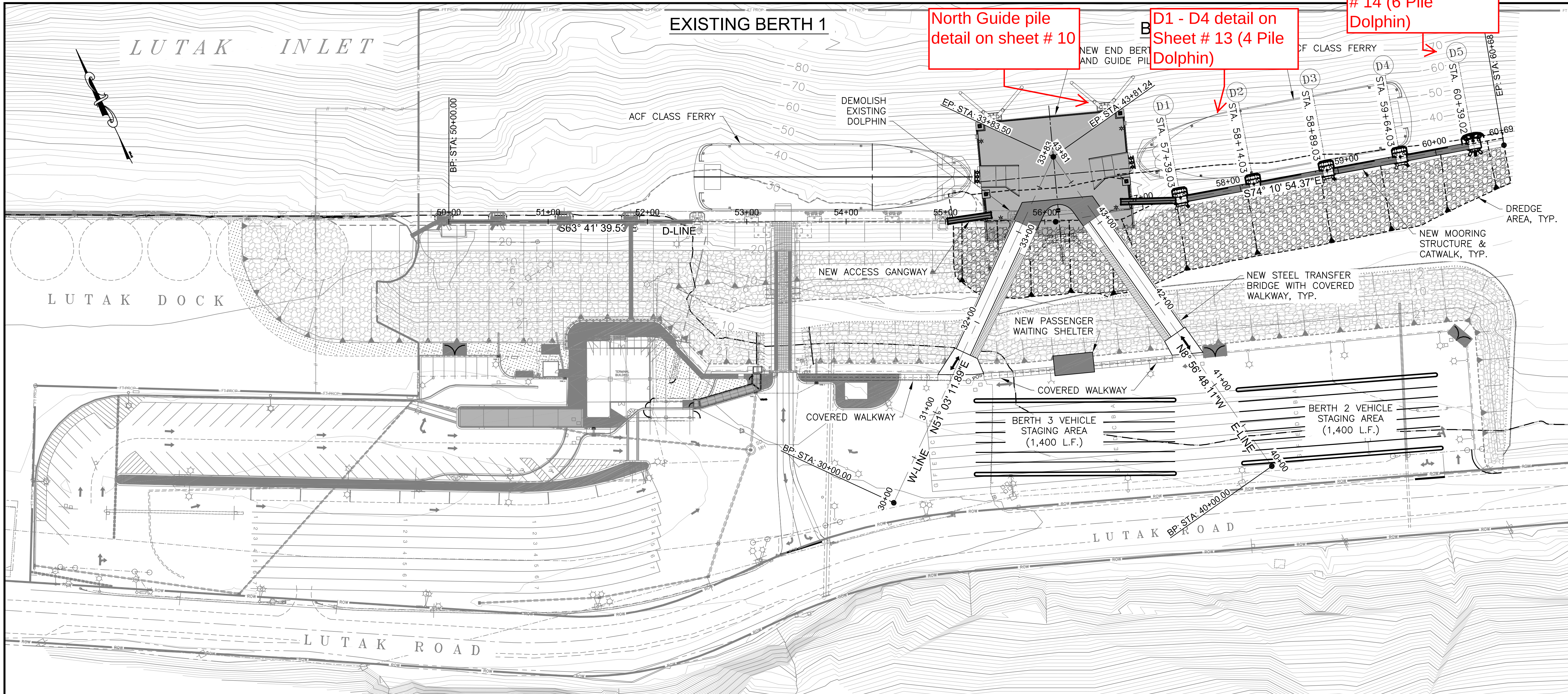

SITE PLAN

50' 0 50' 100'
GRAPHIC SCALE (FT)
1" = 50'

LEGEND

— FT PROP —	PROPOSED PROPERTY BOUNDARY
— ROW —	RIGHT OF WAY LINE
————	PROPERTY EASEMENT
[pattern]	ARMOR ROCK
[pattern]	EXISITNG ARMOR ROCK
·››››››››	LIMITS OF FILL
- - - - - -	LIMITS OF CUT

DRAWING SCALES ARE FOR FULL-SIZE SHEETS. IF NO SCALE SHOWN, USE DIMENSIONS.

DESIGNED BY: V. PHAN
CHECKED BY: J. TAYLOR
DRAWN BY: D. GAMEZ

STATE OF ALASKA
DEPARTMENT OF TRANSPORTATION & PUBLIC FACILITIES
SOUTHCOAST REGION

AHMS HAINES FERRY TERMINAL
END BERTH FACILITY

SITE PLAN

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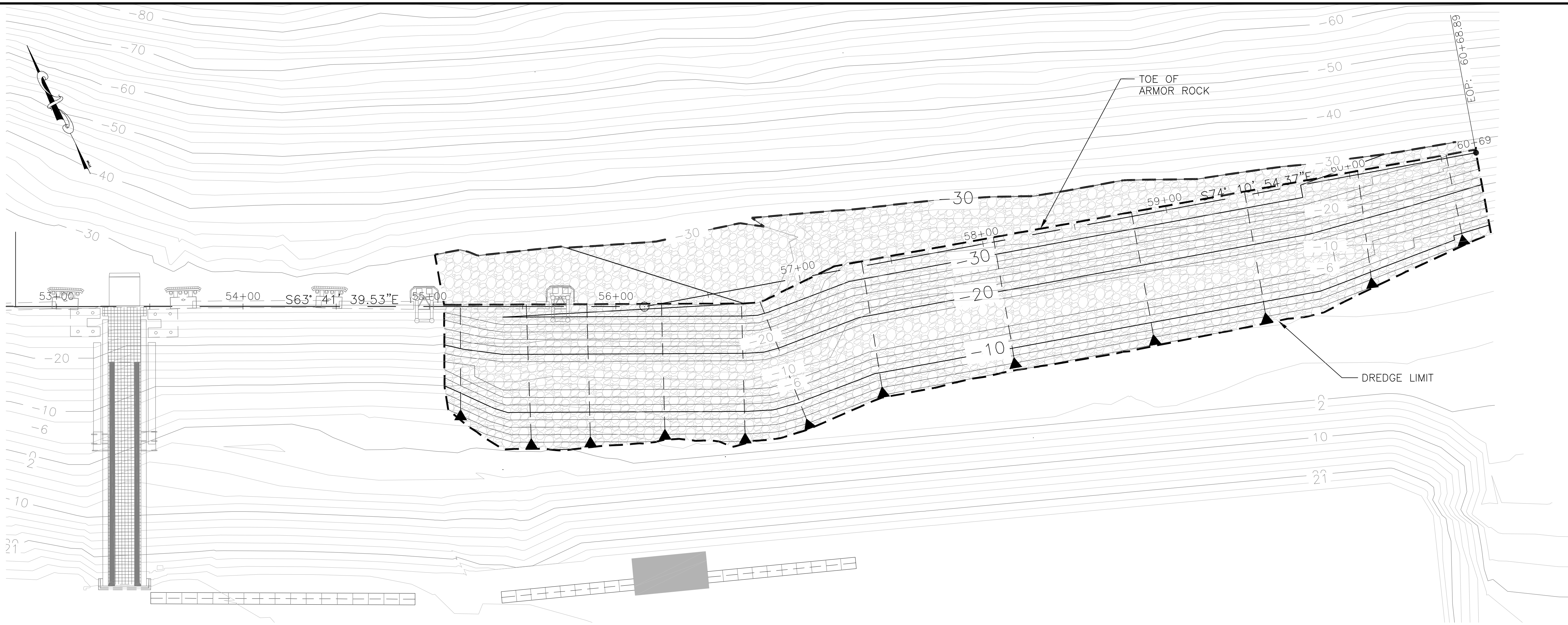

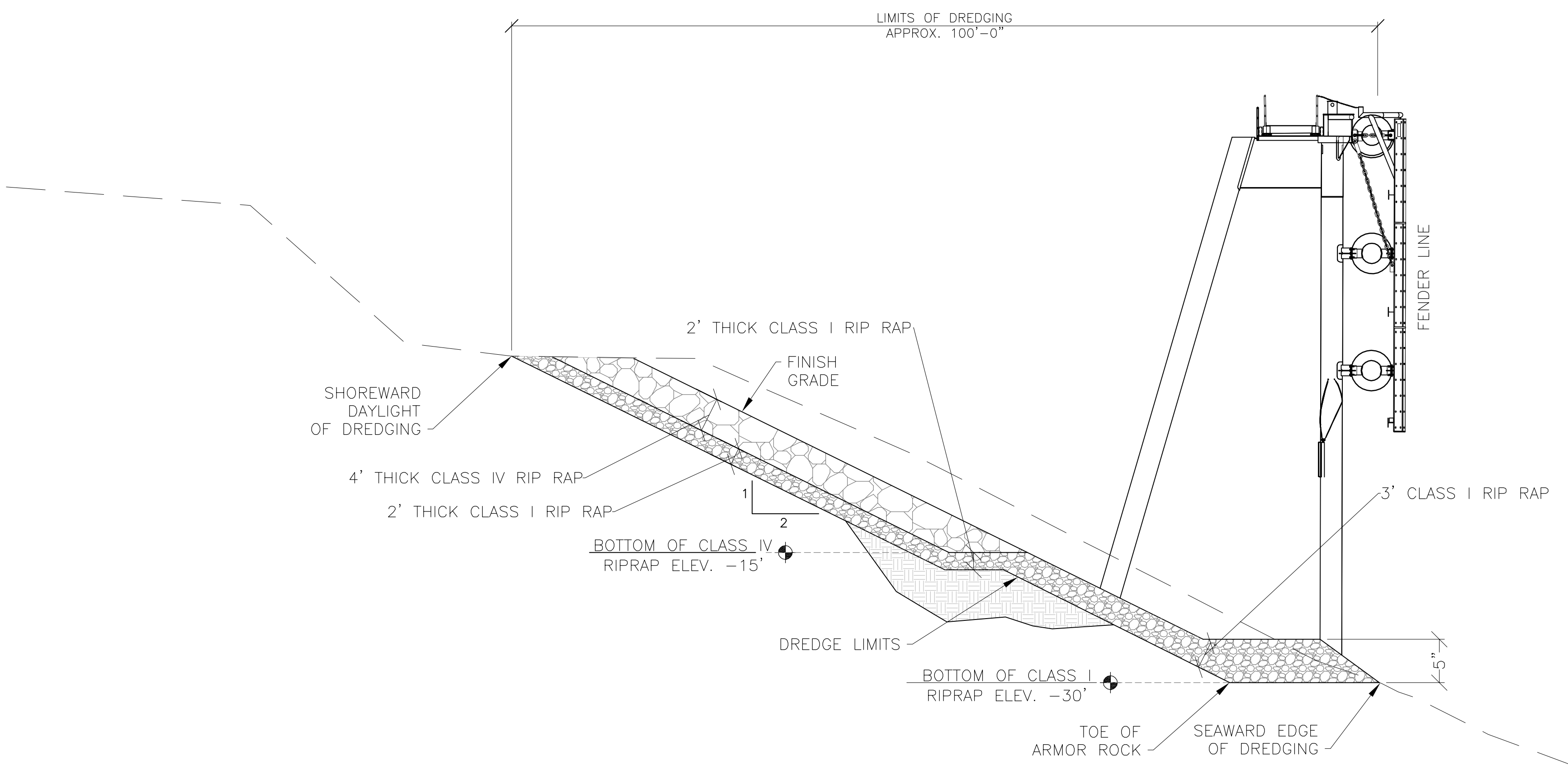

NOTES:

1. RIP RAP SHOWN IN GRAY FOR CLARITY.

30' 0 30' 60'
GRAPHIC SCALE (FT)
1" = 30'

DRAWING SCALES ARE FOR FULL-SIZE SHEETS. IF NO SCALE SHOWN, USE DIMENSIONS.

DESIGNED BY: V. PHAN
CHECKED BY: D. PLAYTER
DRAWN BY: T. CHANCELLOR

STATE OF ALASKA
DEPARTMENT OF TRANSPORTATION
& PUBLIC FACILITIES
SOUTHCOAST REGION

AHMS HAINES FERRY TERMINAL
END BERTH FACILITY

DREDGE PLAN

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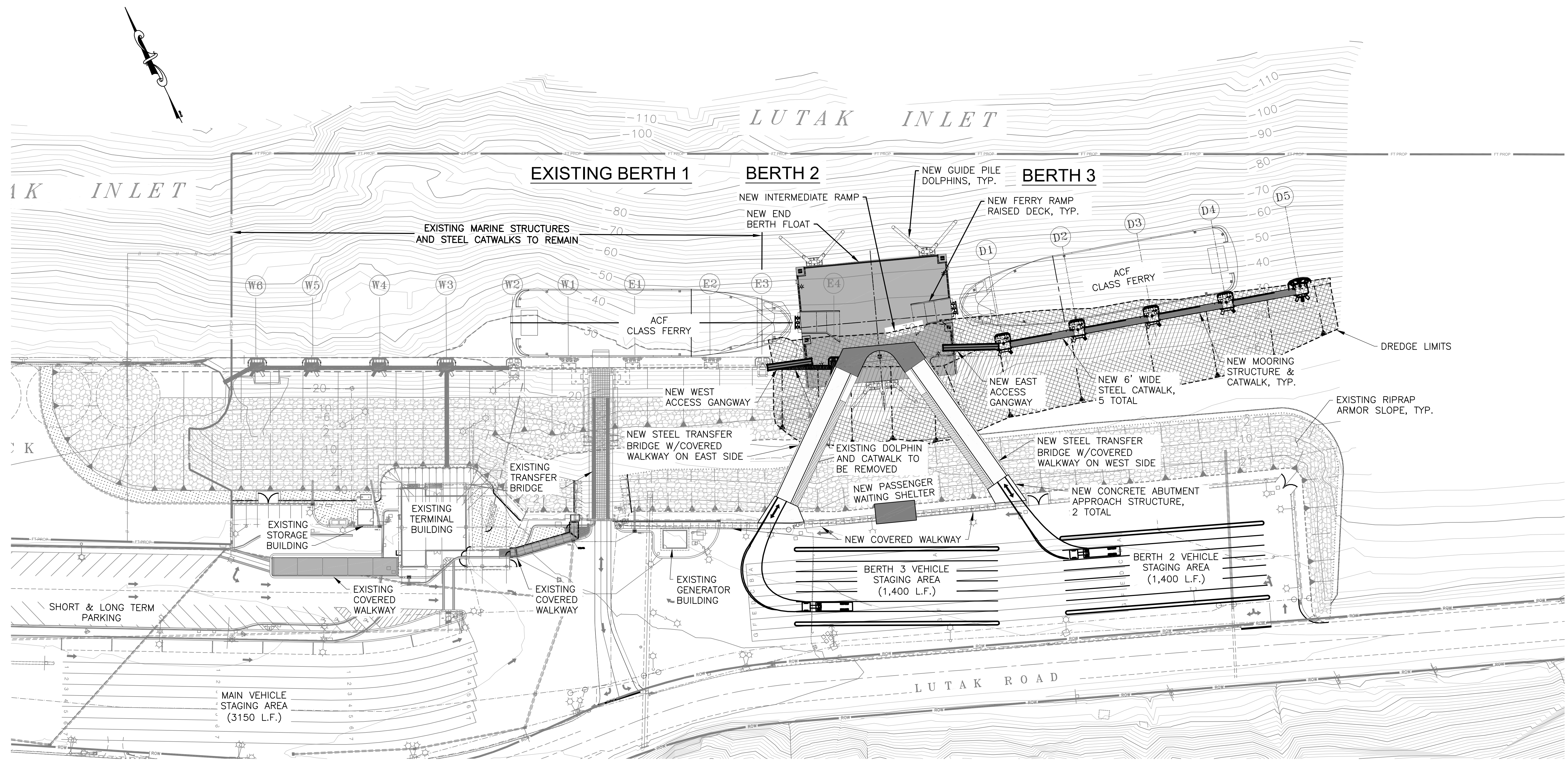

PLAN

50' 0 50' 100'
GRAPHIC SCALE (FT)
1" = 50'

DRAWING SCALES ARE FOR FULL-SIZE SHEETS. IF NO SCALE SHOWN, USE DIMENSIONS.

DESIGNED BY: V. PHAN	STATE OF ALASKA DEPARTMENT OF TRANSPORTATION & PUBLIC FACILITIES SOUTHCOAST REGION AHMS HAINES FERRY TERMINAL END BERTH FACILITY **GENERAL ARRANGEMENT PLAN ALASKA CLASS FERRY (ACF)**
CHECKED BY: D. PLAYTER	
DRAWN BY: T. CHANCELLOR	

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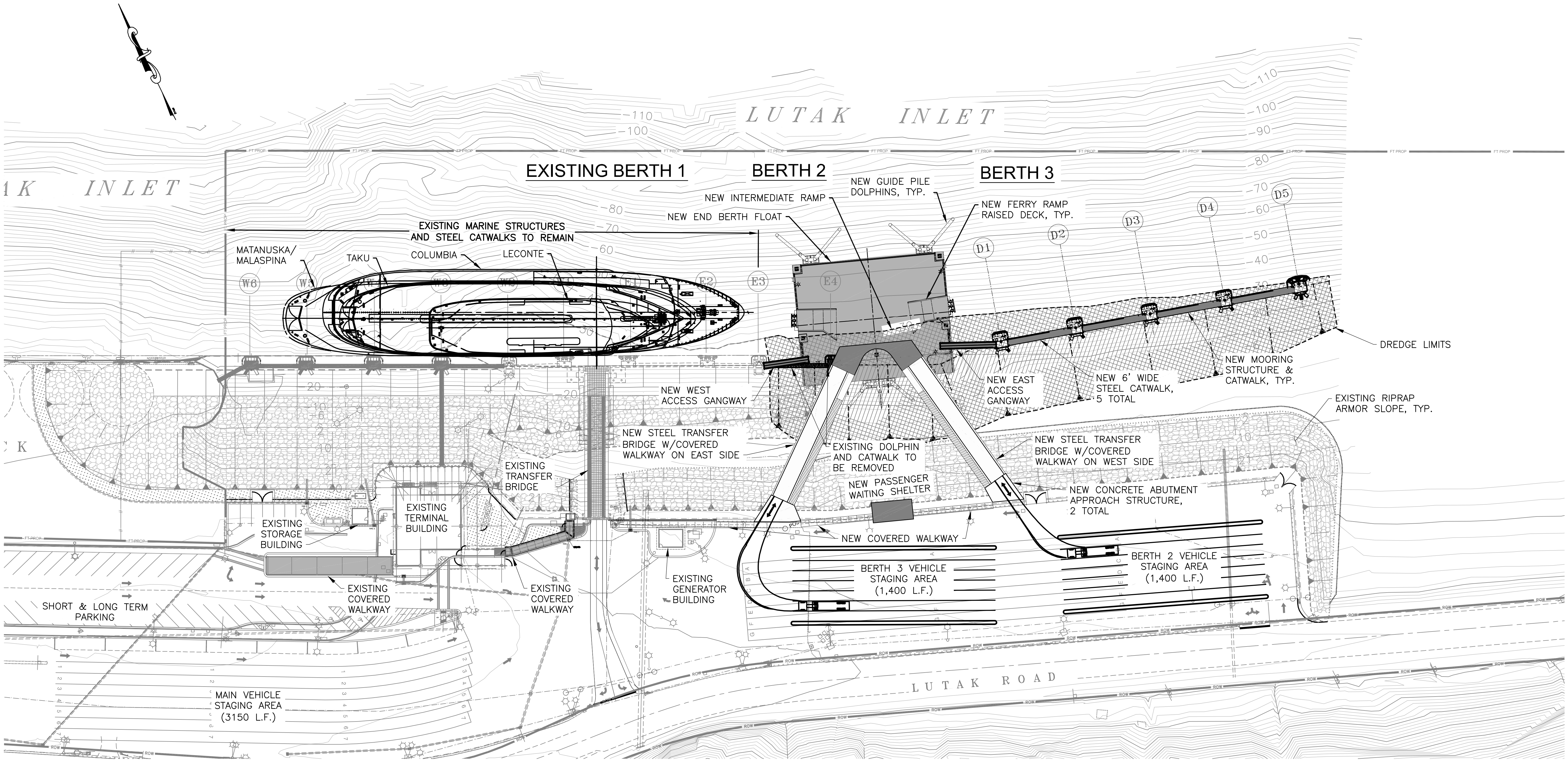

PLAN

GRAPHIC SCALE (FT) 1" = 50'

DRAWING SCALES ARE FOR FULL-SIZE SHEETS. IF NO SCALE SHOWN, USE DIMENSIONS.

DESIGNED BY: V. PHAN
CHECKED BY: D. PLAYTER
DRAWN BY: T. CHANCELLOR

STATE OF ALASKA
DEPARTMENT OF TRANSPORTATION & PUBLIC FACILITIES
SOUTHCOAST REGION

AHMS HAINES FERRY TERMINAL
END BERTH FACILITY

GENERAL ARRANGEMENT PLAN SIDE BERTH VESSELS

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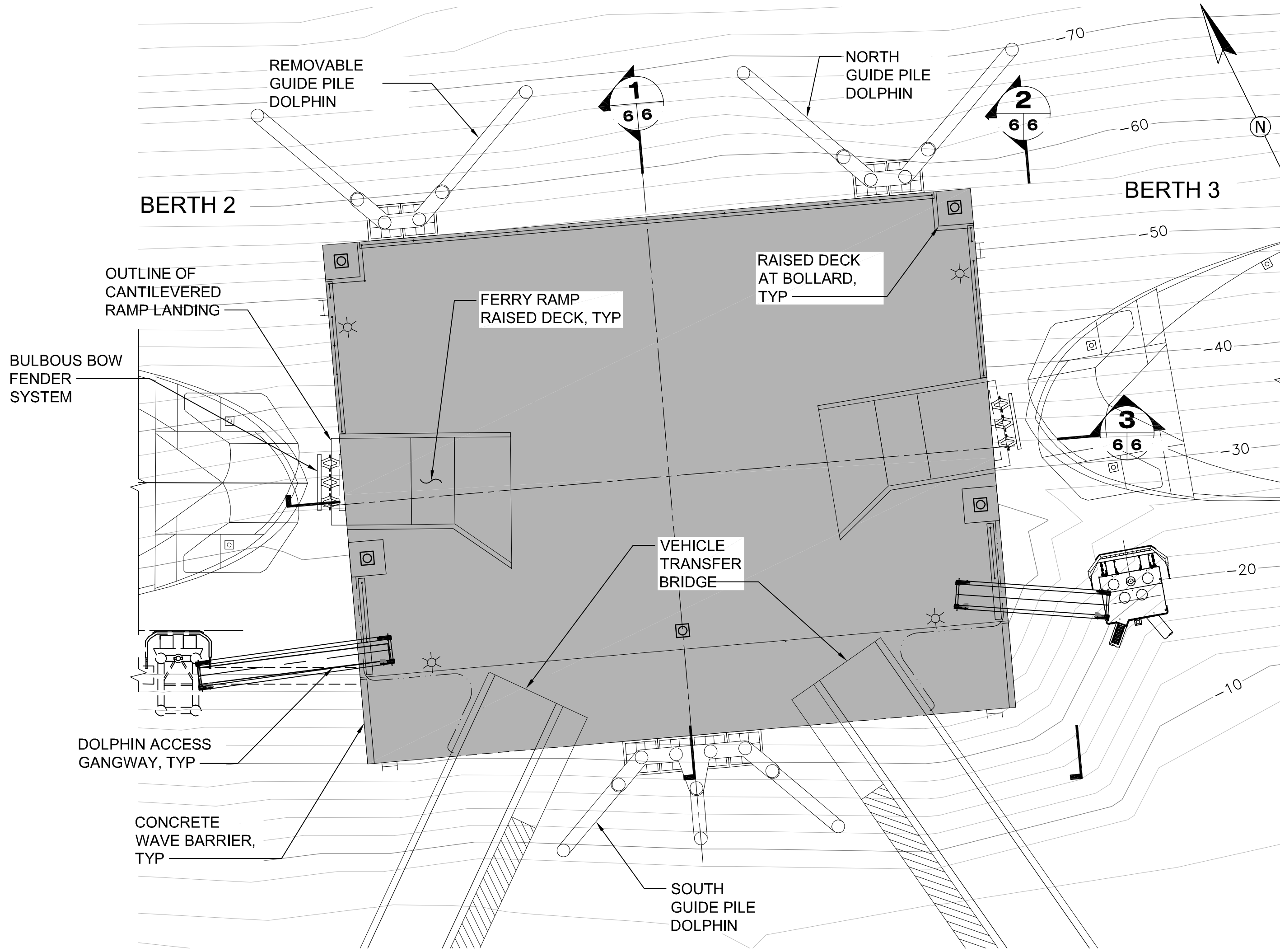

PLAN - FLOAT SURFACE FEATURES

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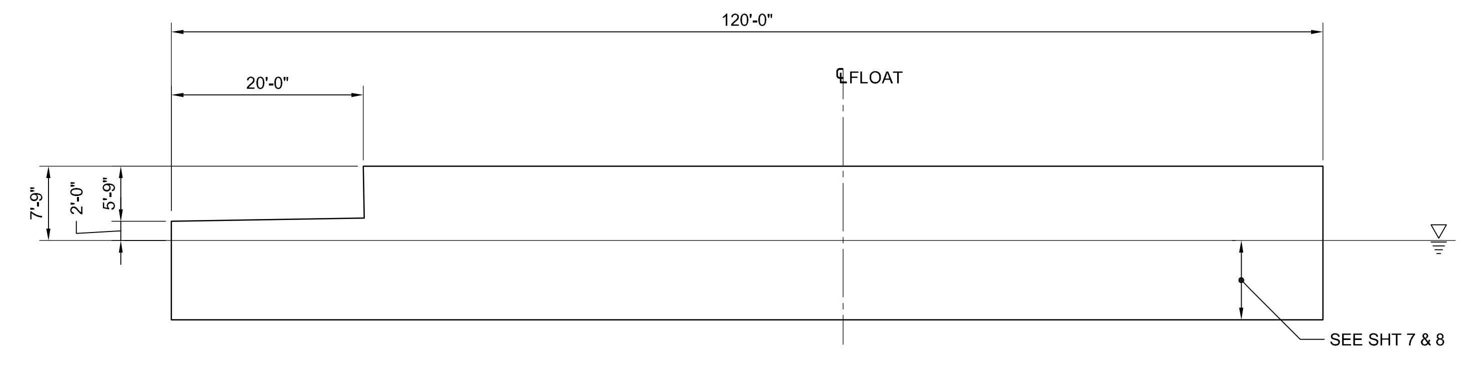

1/66 SECTION - @ CENTER LINE OF FLOAT

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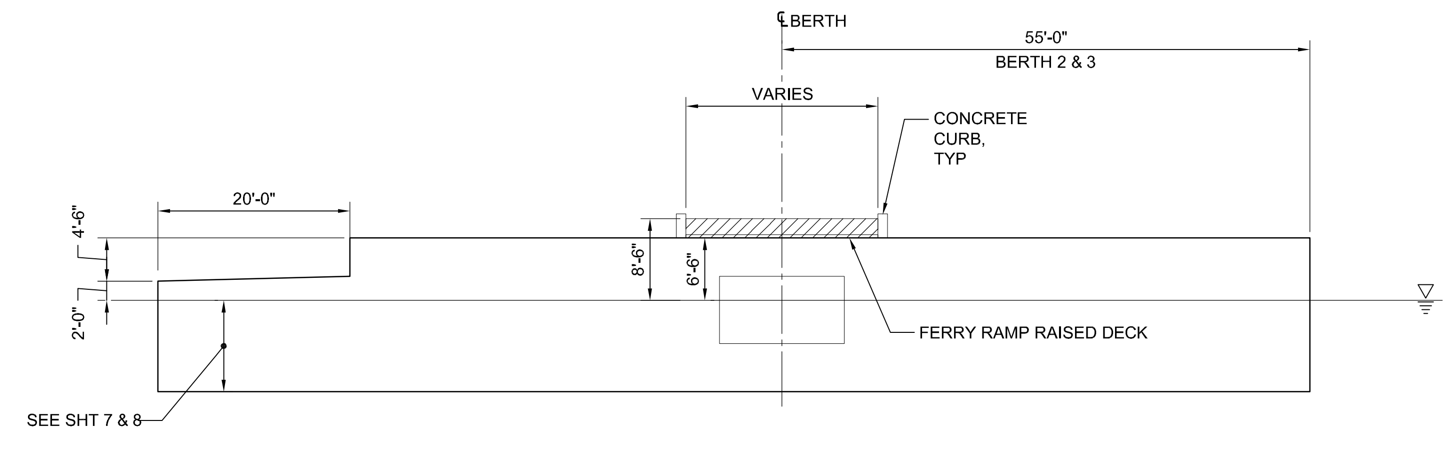

2/66 ELEVATION - AT BERTH 3
(OPPOSITE AT BERTH 2)

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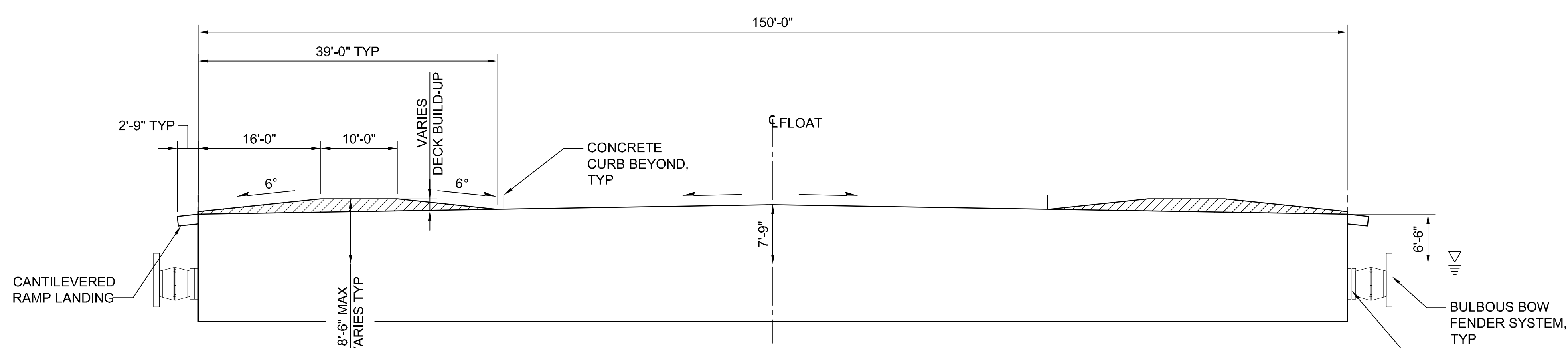

3/66 SECTION - AT CENTERLINE OF FLOAT

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GRAPHIC SCALE (FT)

DRAWING SCALES ARE FOR FULL-SIZE SHEETS. IF NO SCALE SHOWN, USE DIMENSIONS.

DESIGNED BY: FLY
CHECKED BY: CSB
DRAWN BY: JDM

STATE OF ALASKA
DEPARTMENT OF TRANSPORTATION
& PUBLIC FACILITIES
SOUTHCOAST REGION

AHMS HAINES FERRY TERMINAL
END BERTH FACILITY

FLOAT PLAN, ELEVATION & SECTIONS

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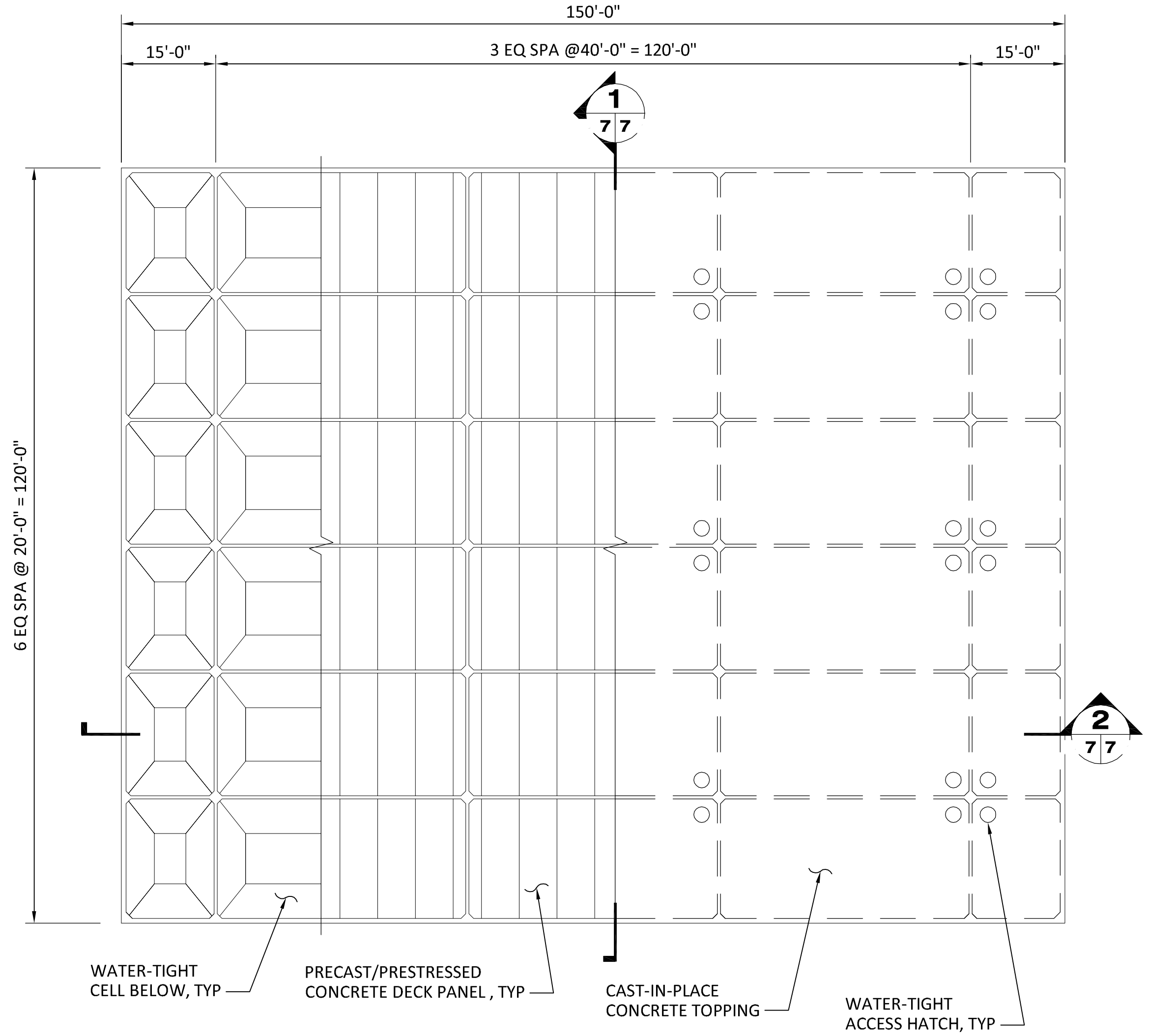
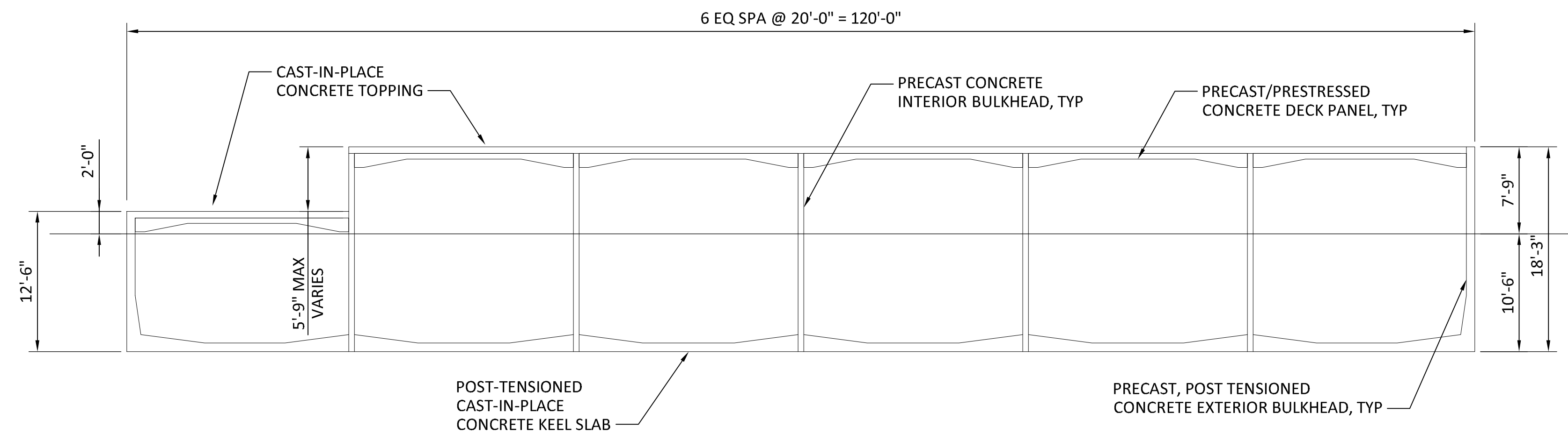


PLAN - CONCRETE FLOAT

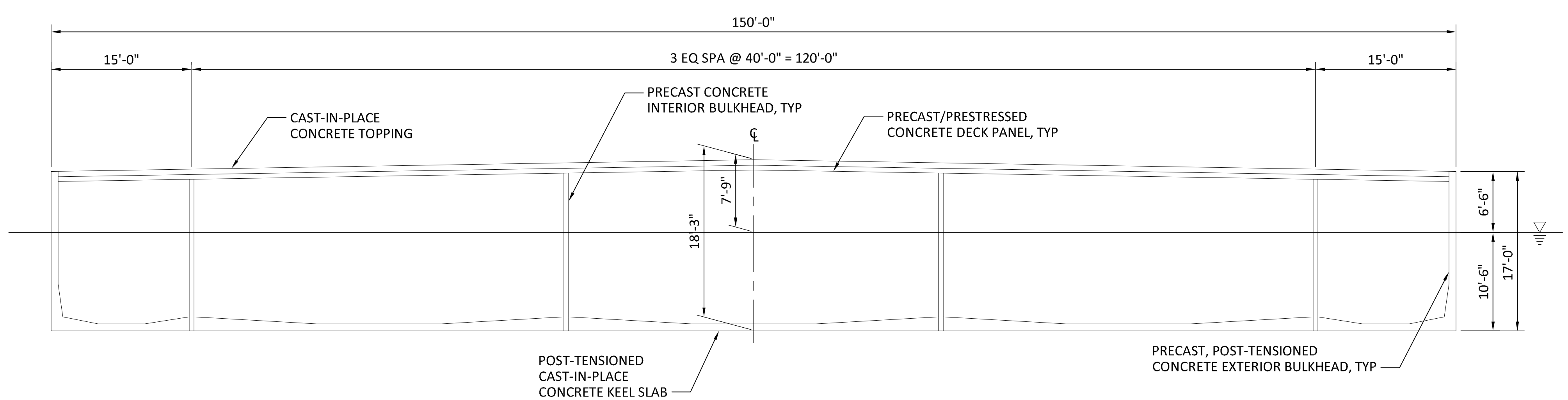
15' 0 15' 30'
GRAPHIC SCALE (FT)

NOTE:
SURFACE FEATURES NOT SHOWN.



1
7 7
SECTION - CONCRETE FLOAT @ CENTERLINE

8' 0 8' 16'
GRAPHIC SCALE (FT)



2
7 7
SECTION - CONCRETE FLOAT

8' 0 8' 16'
GRAPHIC SCALE (FT)

DRAWING SCALES ARE FOR FULL-SIZE SHEETS. IF NO SCALE SHOWN, USE DIMENSIONS.

DESIGNED BY: FLY
CHECKED BY: CSB
DRAWN BY: JDM

STATE OF ALASKA
DEPARTMENT OF TRANSPORTATION
& PUBLIC FACILITIES
SOUTHCOAST REGION

AHMS HAINES FERRY TERMINAL
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CONCRETE FLOAT PLAN & SECTIONS

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Friday, July 29, 2016 3:43:44 PM
HEDGLIN, TOBY/SEA

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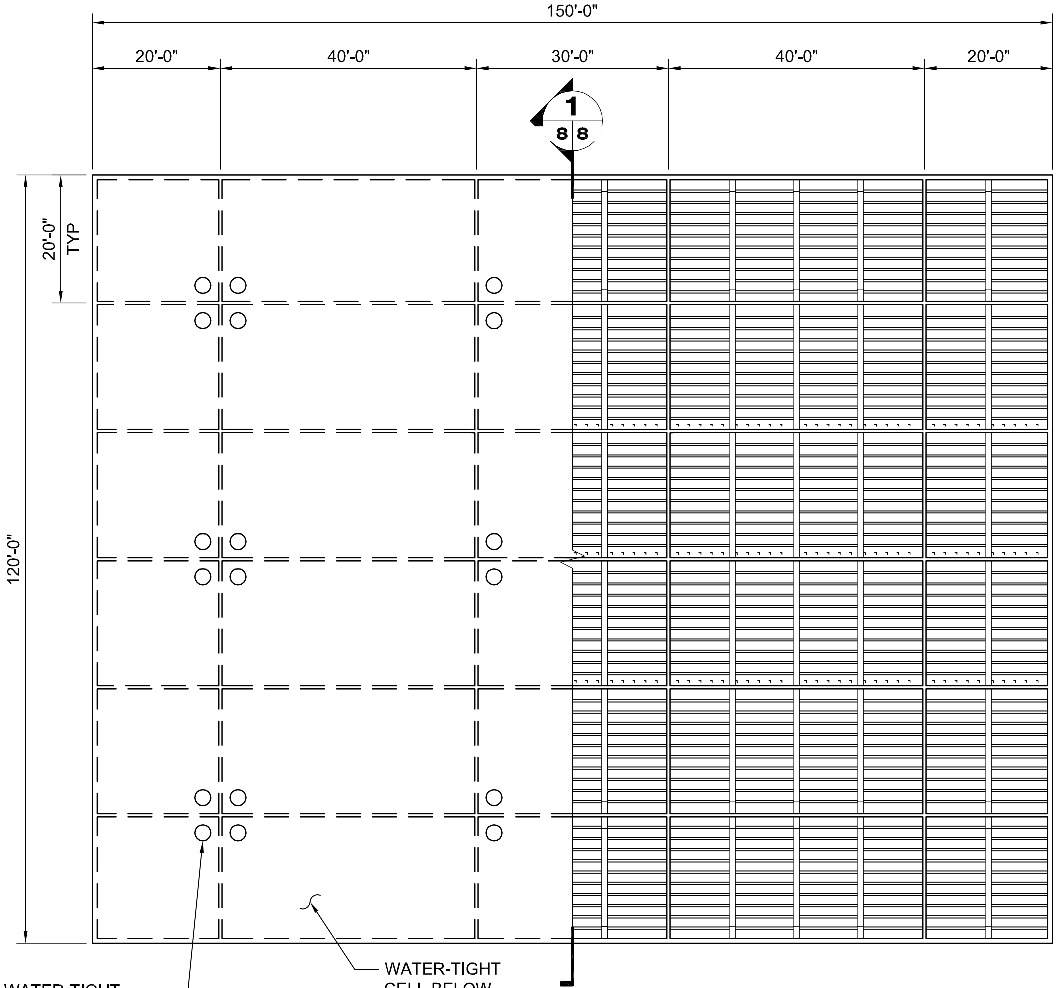
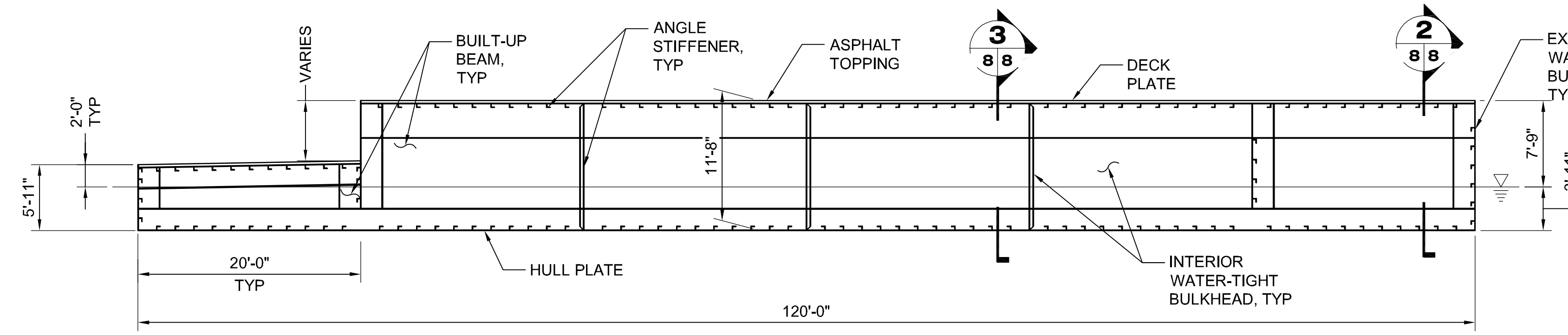
NO.	DATE	DESCRIPTION	Z684640000/ 0955017	2016	8	18



PLAN - STEEL FLOAT

15' 0 15' 30'
GRAPHIC SCALE (FT)

NOTES:
1. INTERIOR FRAMING FOR FENDER SYSTEMS, GUIDE PILE DOLPHIN FRAMES AND VEHICLE TRANSFER BRIDGES NOT SHOWN.



1 (8|8) SECTION - TYPICAL TRANSVERSE

8' 0 8' 16'
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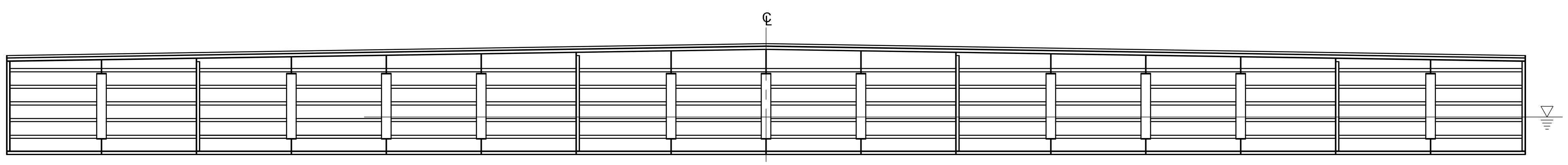
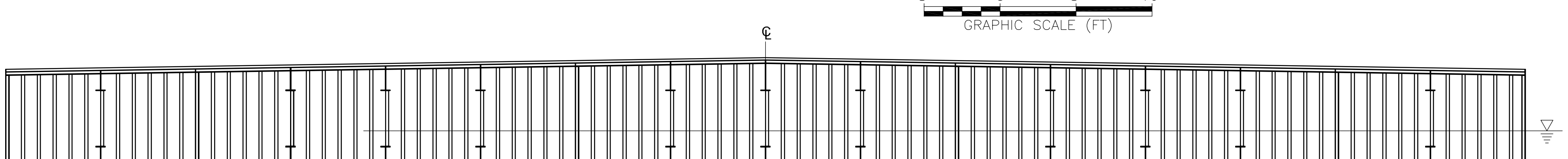


2 (8|8) SECTION - TYPICAL LONGITUDIINAL (EXTERIOR)

8' 0 8' 16'
GRAPHIC SCALE (FT)



3 (8|8) SECTION - TYPICAL LONGITUDIINAL (INTERIOR)

8' 0 8' 16'
GRAPHIC SCALE (FT)

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DRAWN BY: JDM

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STEEL FLOAT PLAN & SECTIONS

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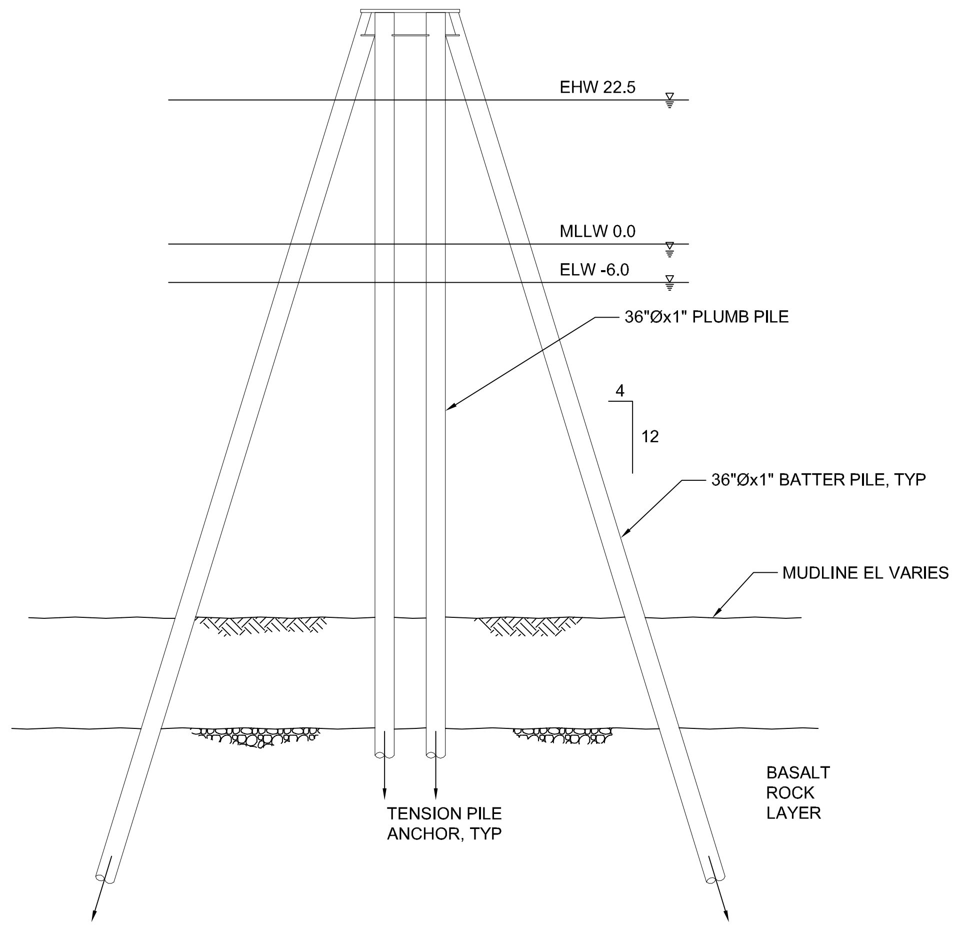
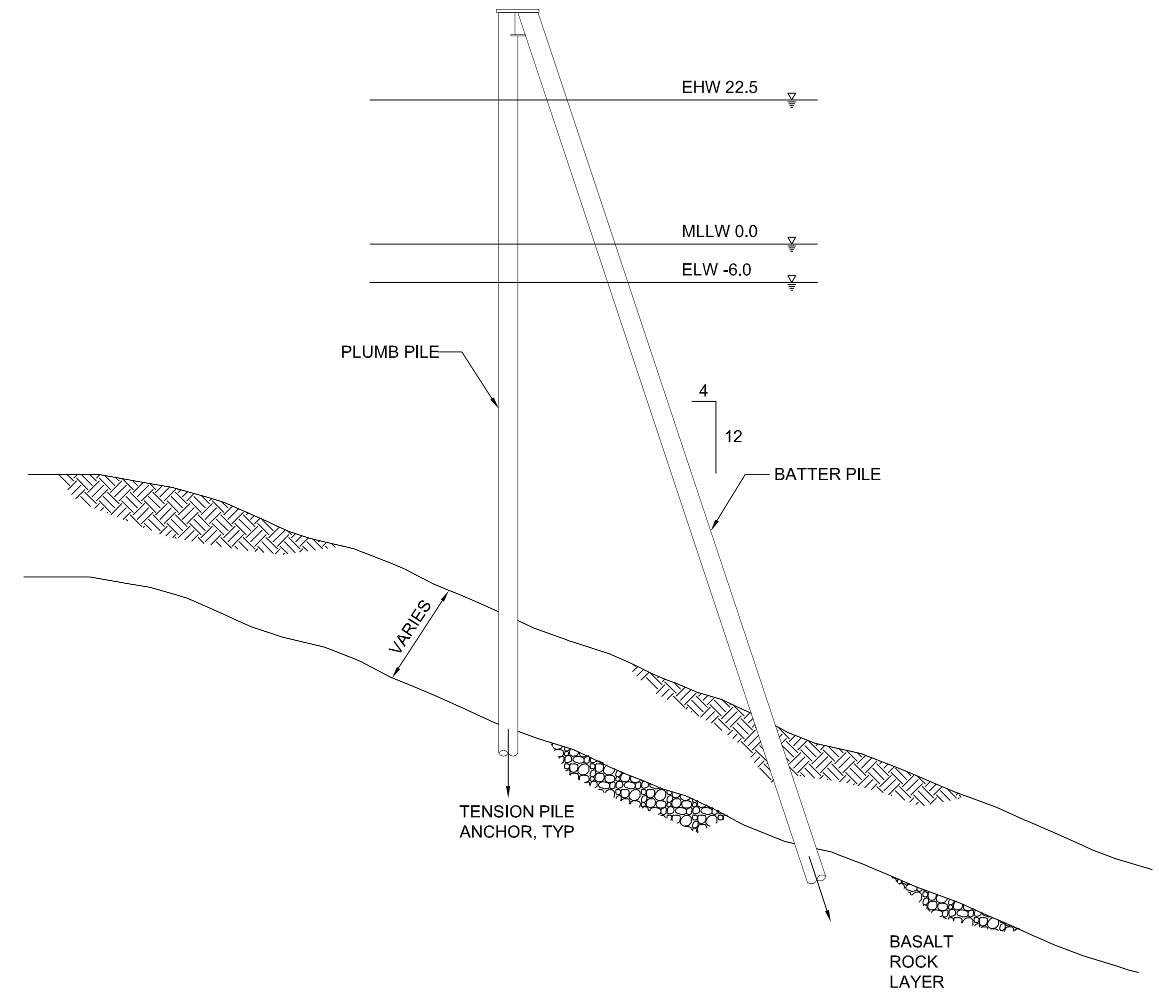


FRONT VIEW



SIDE VIEW

NORTH GUIDE PILE DOLPHIN

15' 0 15' 30'
GRAPHIC SCALE (FT)

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TYPICAL GUIDE PILE DOLPHIN

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TAB: 10
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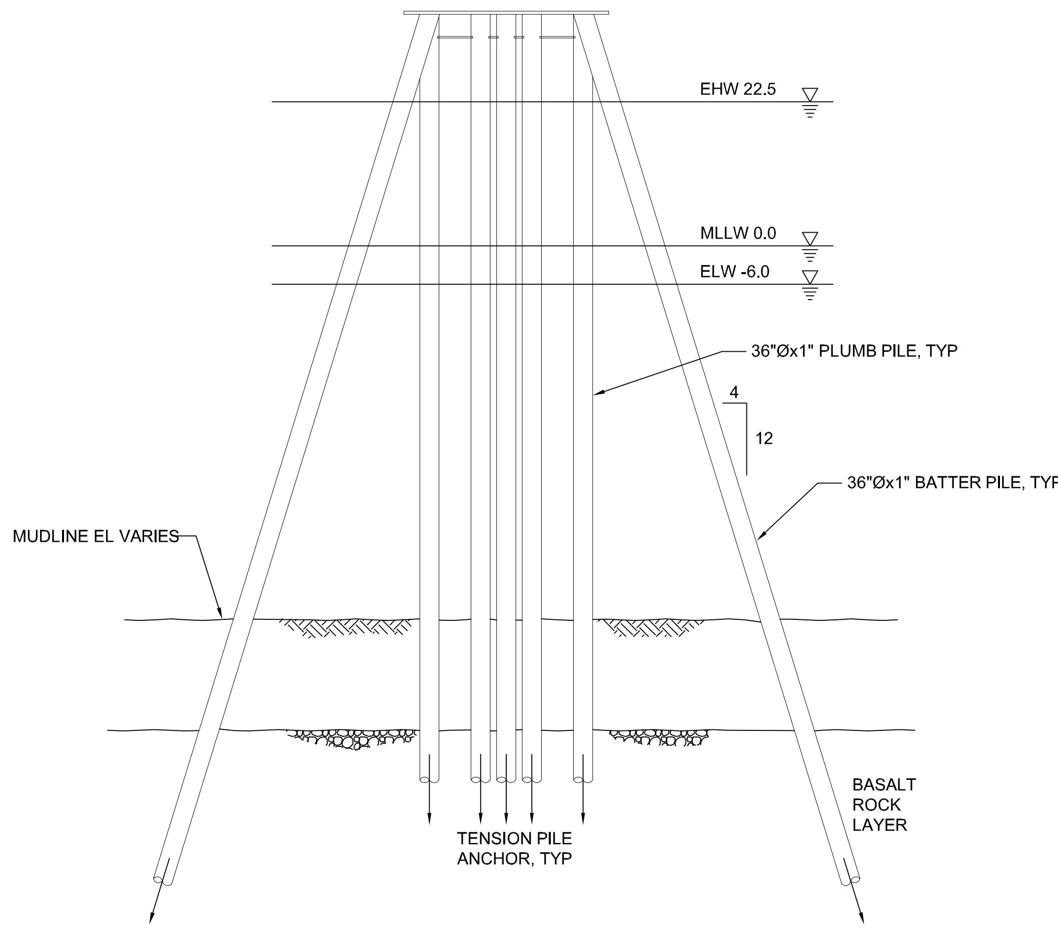
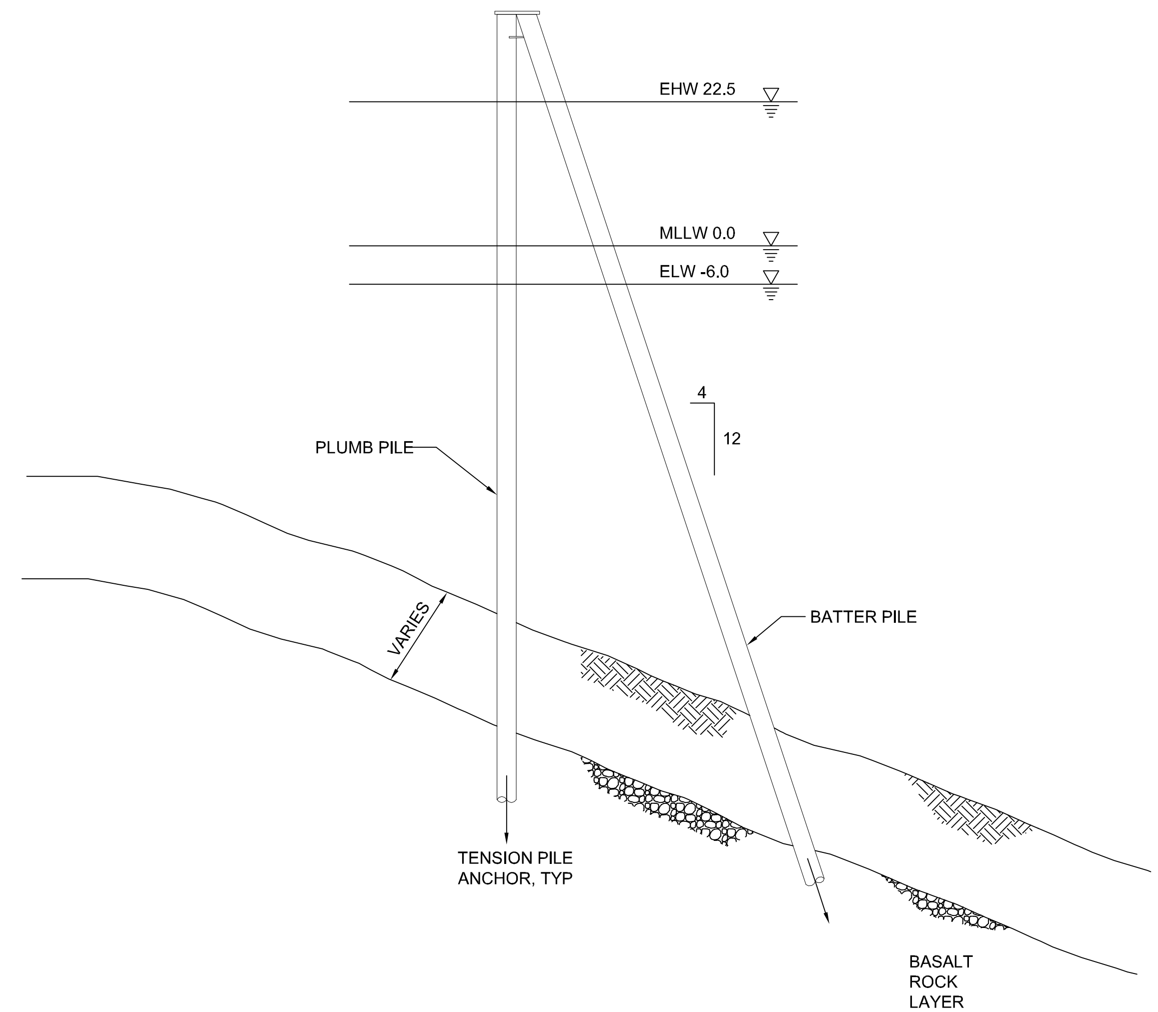


FRONT VIEW



SIDE VIEW

SOUTH GUIDE PILE DOLPHIN

15' 0 15' 30'
GRAPHIC SCALE (FT)

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SOUTH GUIDE PILE DOLPHIN

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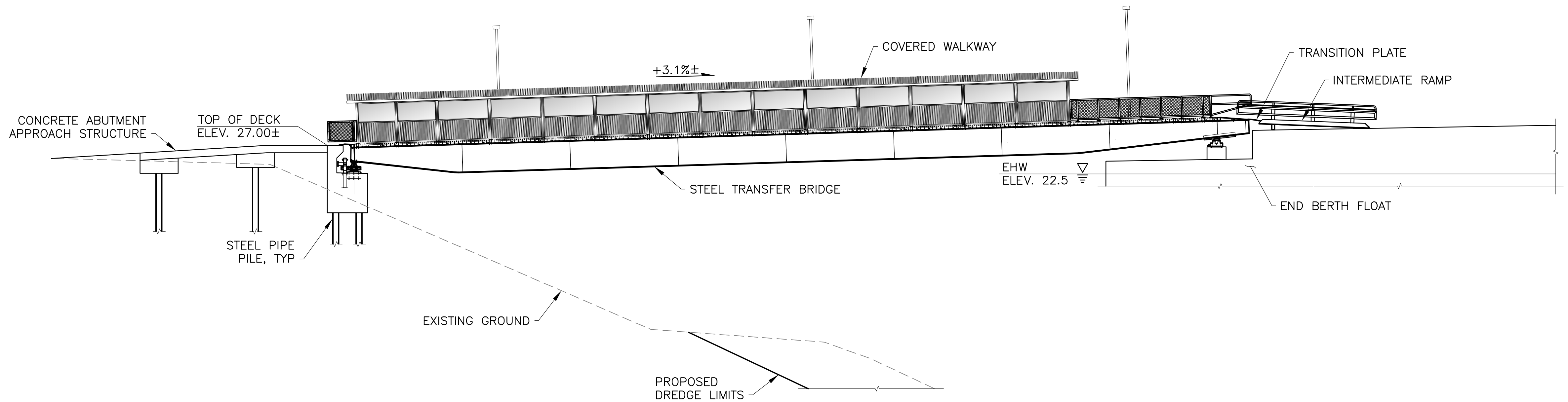
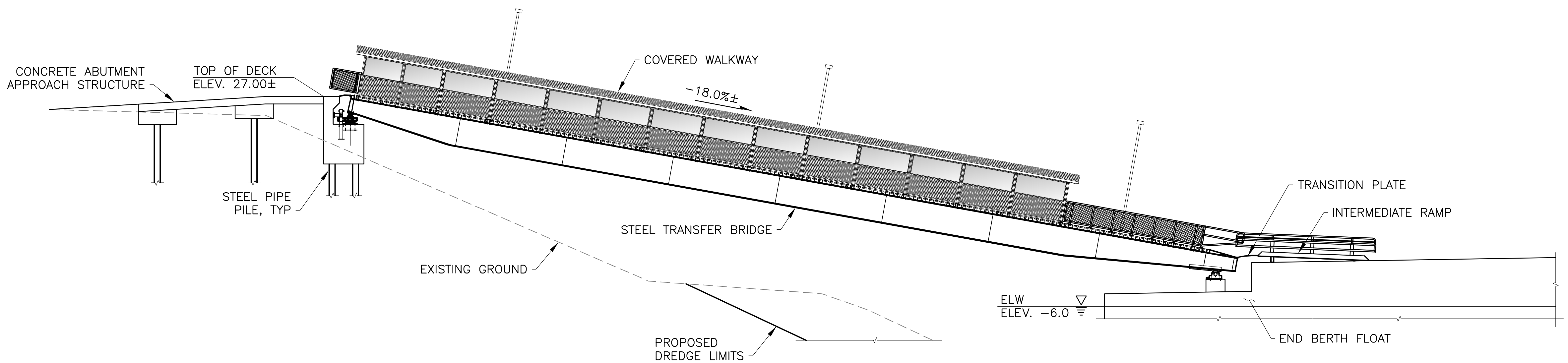


TRANSFER BRIDGE ELEVATION AT EXTREME HIGH WATER



TRANSFER BRIDGE ELEVATION AT EXTREME LOW WATER

10' 0 10' 20'
GRAPHIC SCALE (FT)
1" = 10'

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CHECKED BY: D. PLAYTER
DRAWN BY: T. CHANCELLOR

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TRANSFER BRIDGE HIGH TIDE & LOW TIDE

PATH: C:\PW_WORKDIR\DEN001\THEDGLIN\D0605499\12-TRANSFER BRIDGE BERTH.DWG
TAB: 12 Friday, July 29, 2016 3:16:46 PM HEDGLIN, TOBY/SEA

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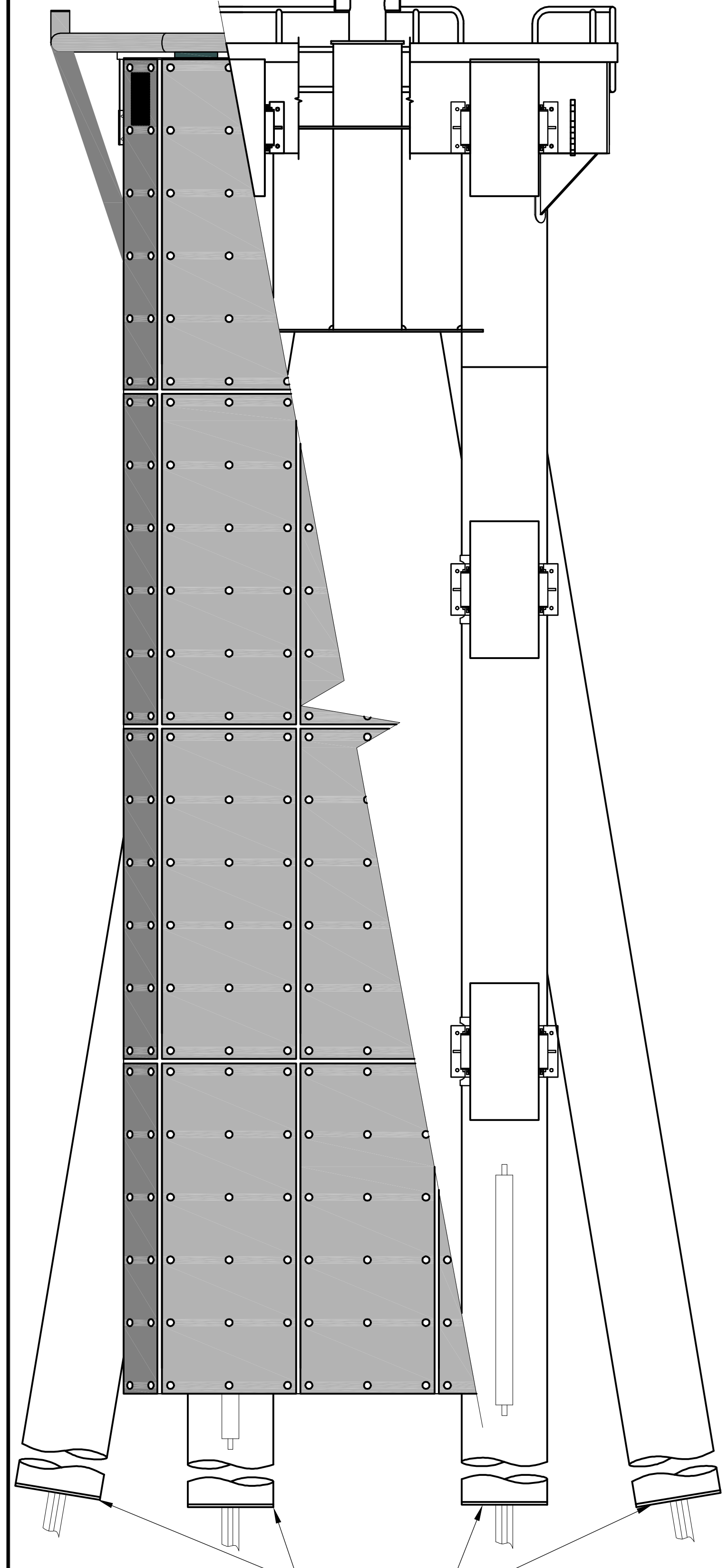
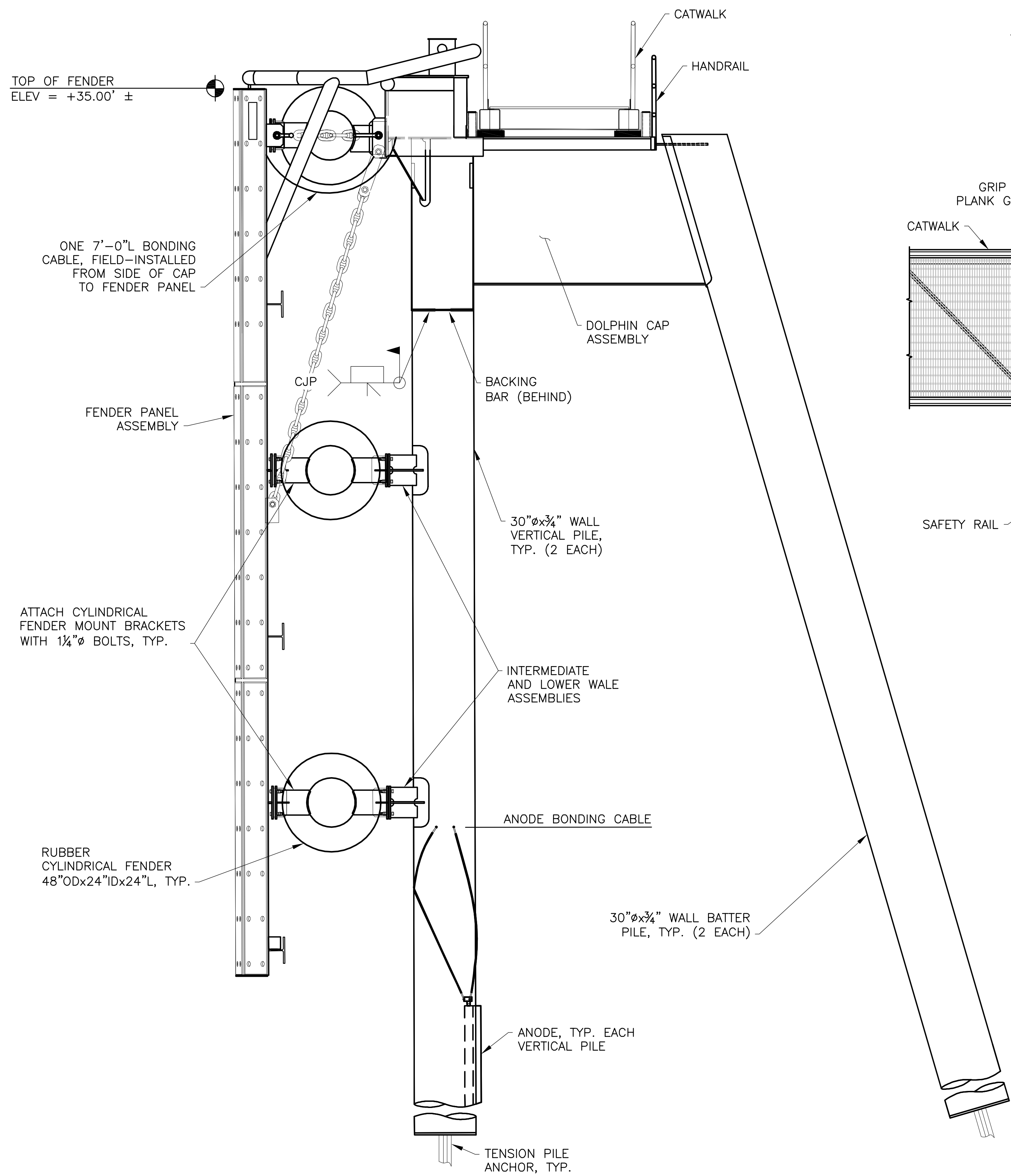
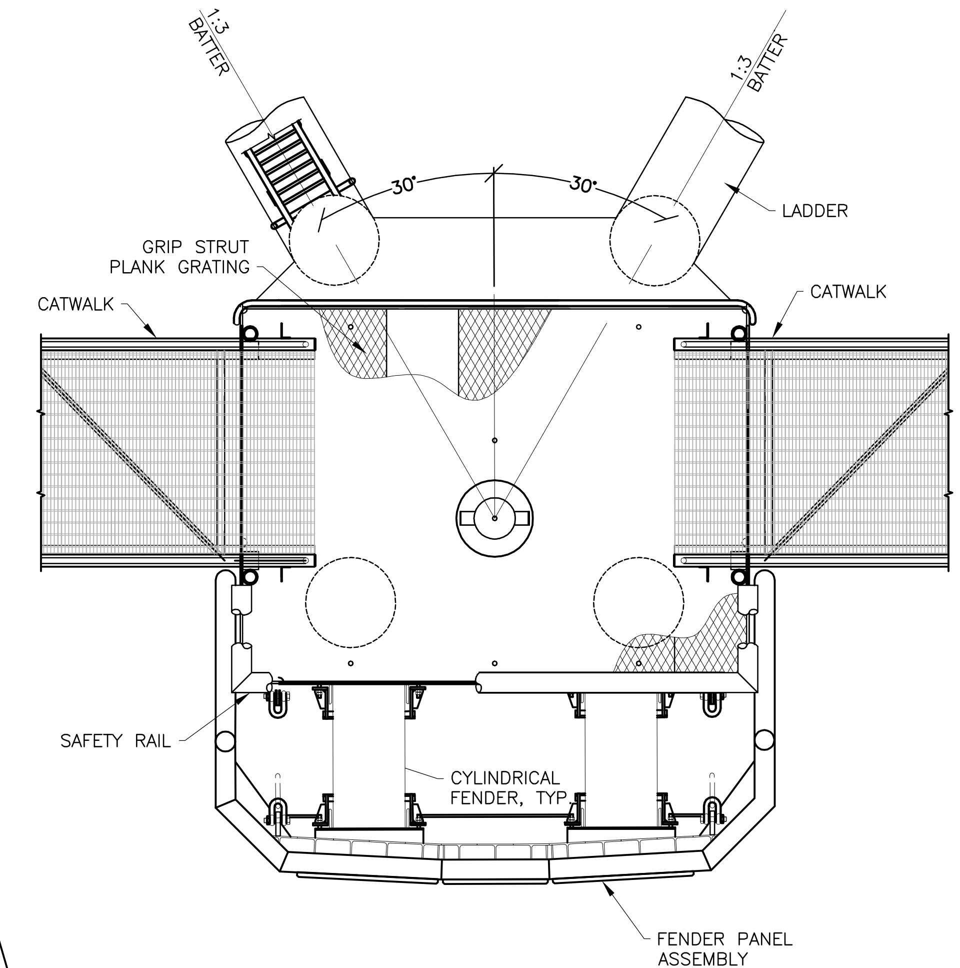


FRONT ELEVATION
4-PILE DOLPHIN



SIDE ELEVATION
4-PILE DOLPHIN



PLAN
4-PILE DOLPHIN

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4-PILE MOORING AND BERTHING DOLPHIN

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DRAWN BY: T. CHANCELLOR

PATH: C:\PW_WORKDIR\DEN001\THEDGLIN\D0605499\13-4-PILE DOLPHIN.DWG
TAB: 13 Friday, July 29, 2016 2:37:07 PM HEDGLIN, TOBY/SEA

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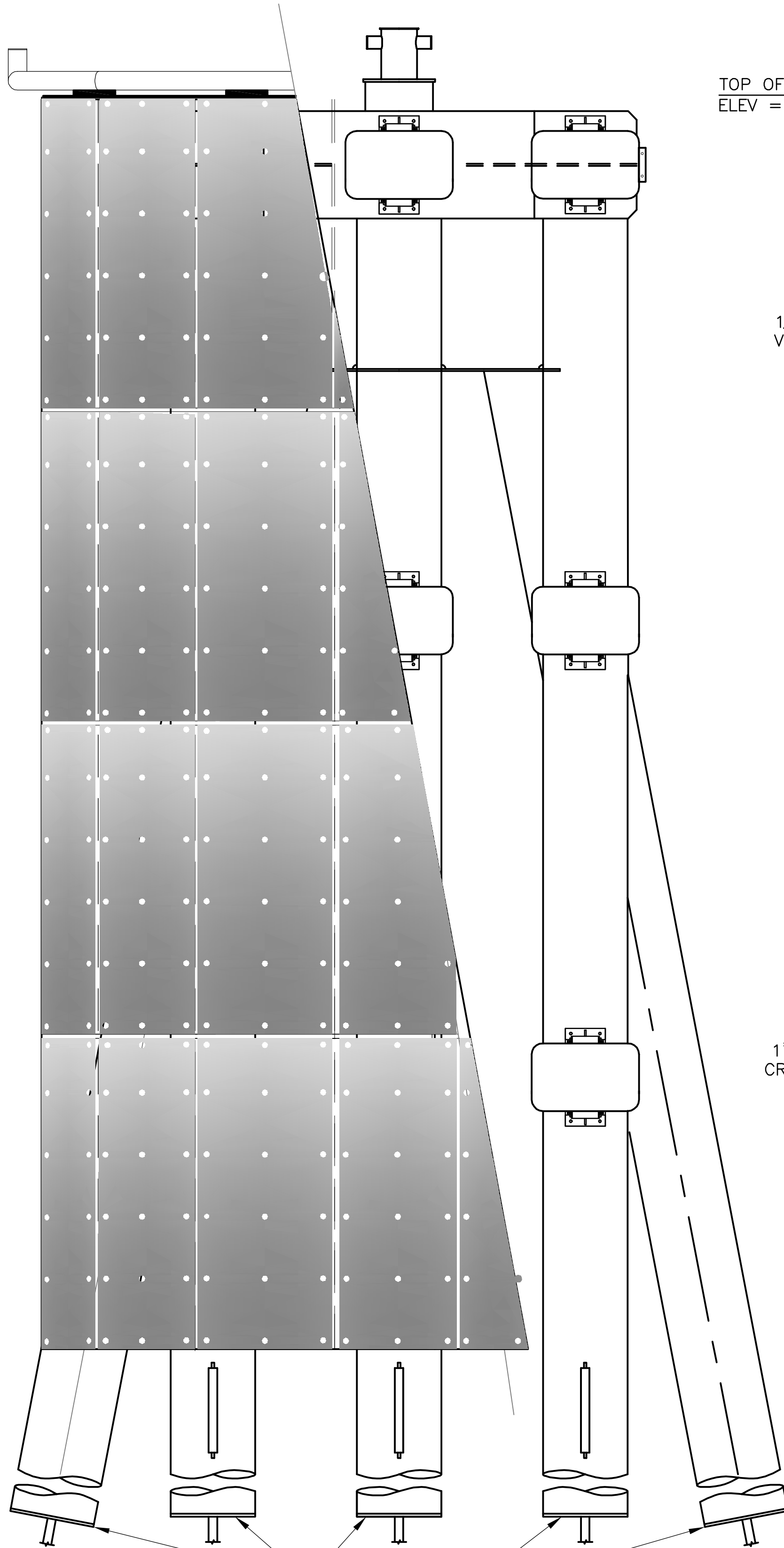
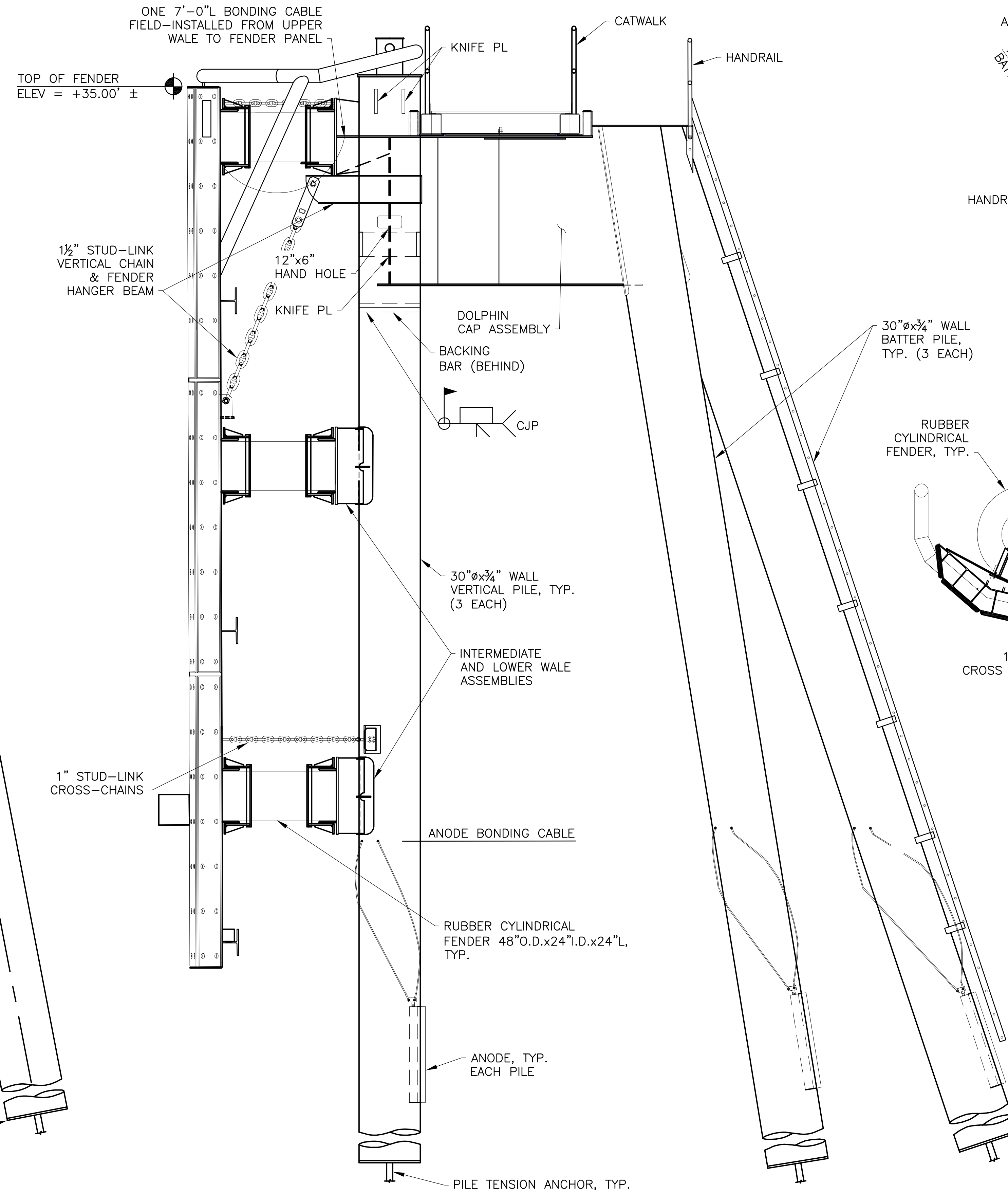
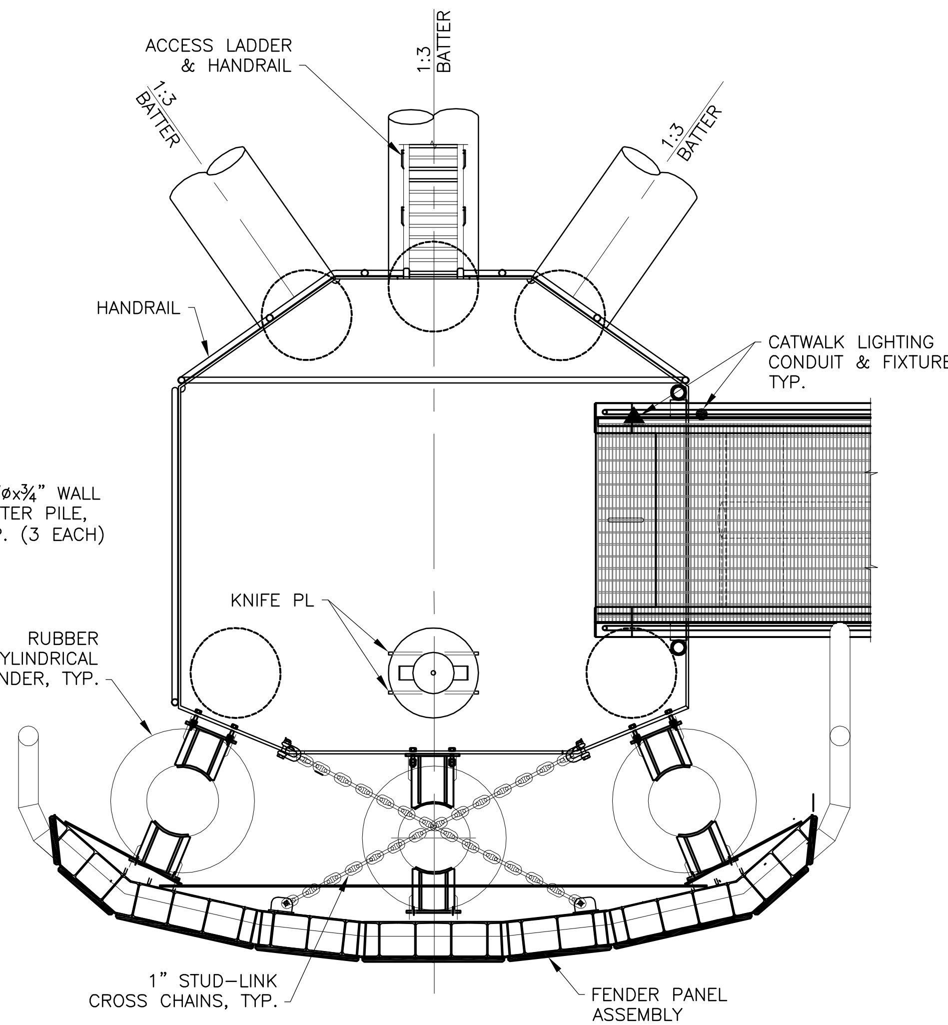


FRONT ELEVATION
6-PILE DOLPHIN



SIDE ELEVATION
6-PILE DOLPHIN



TOP PLAN VIEW
6-PILE DOLPHIN

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6-PILE MOORING AND BERTHING DOLPHIN

PATH: C:\PW_WORKDIR\DEN001\THEDGLIN\D0605499\14-6-PILE DOLPHIN.DWG
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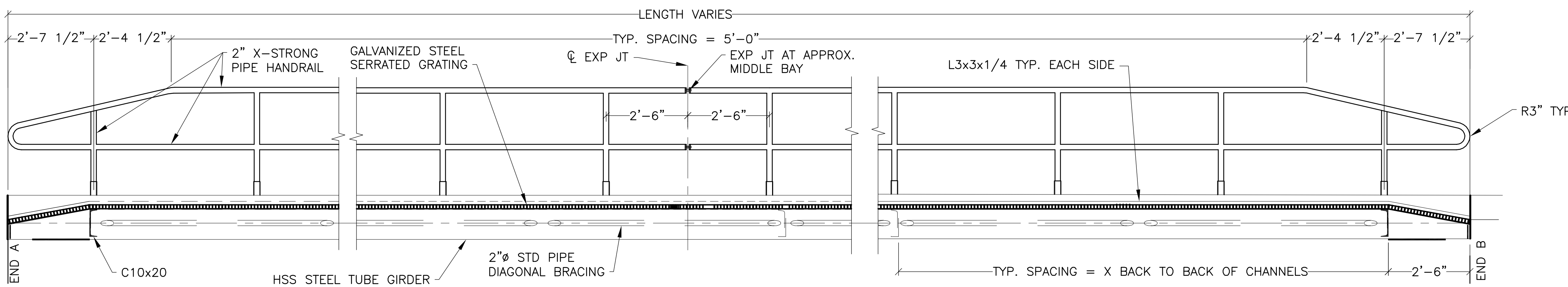
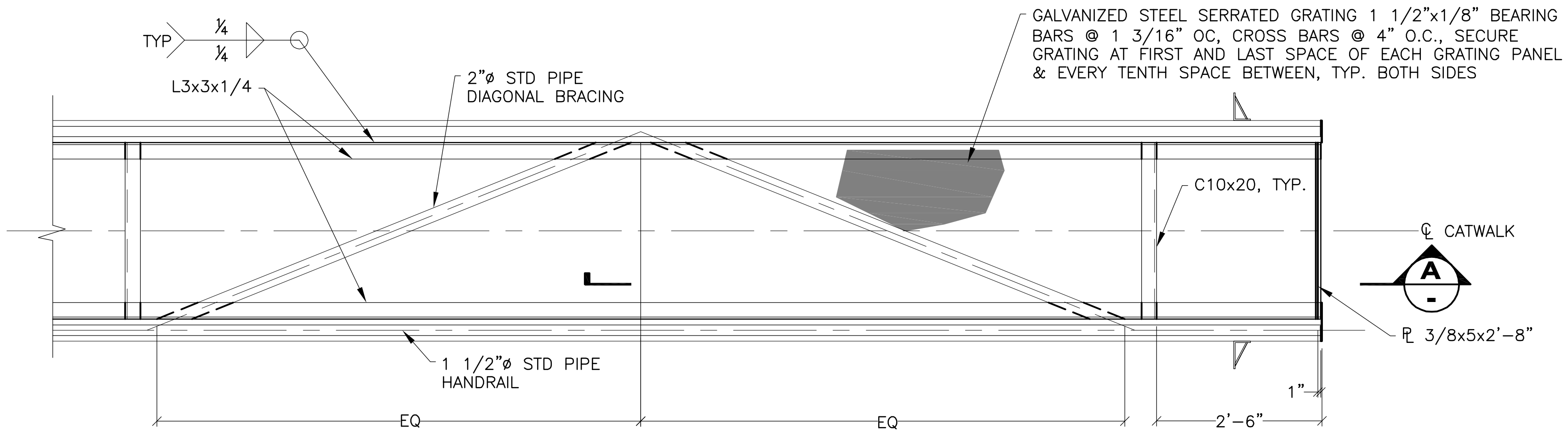
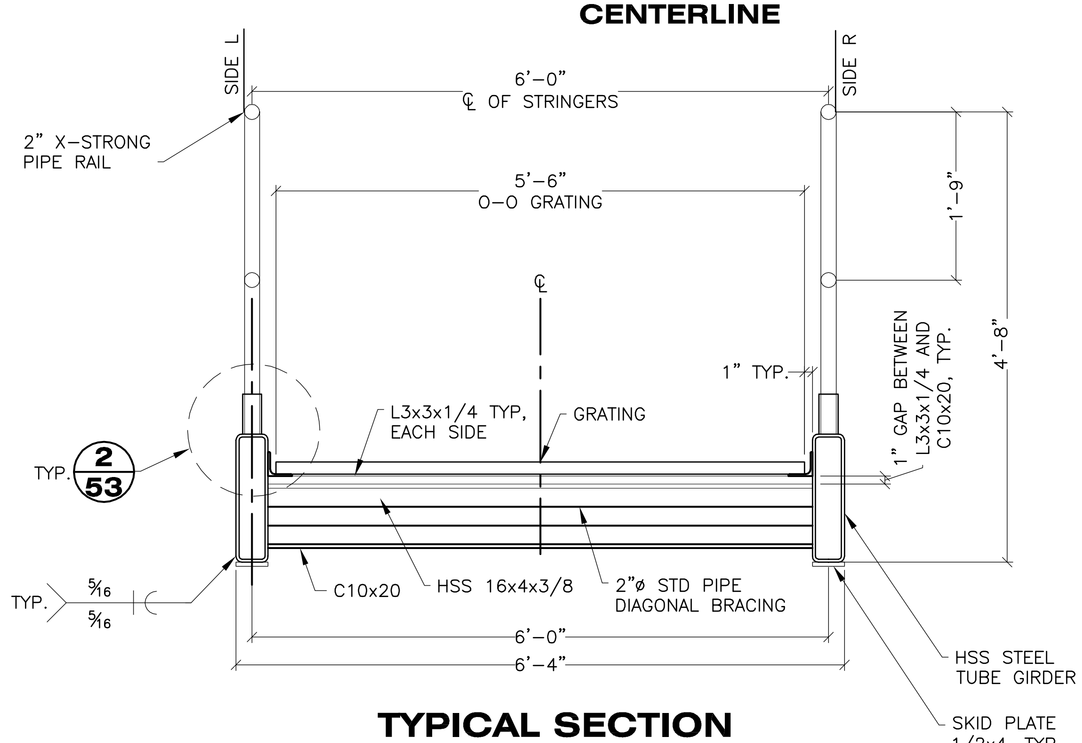


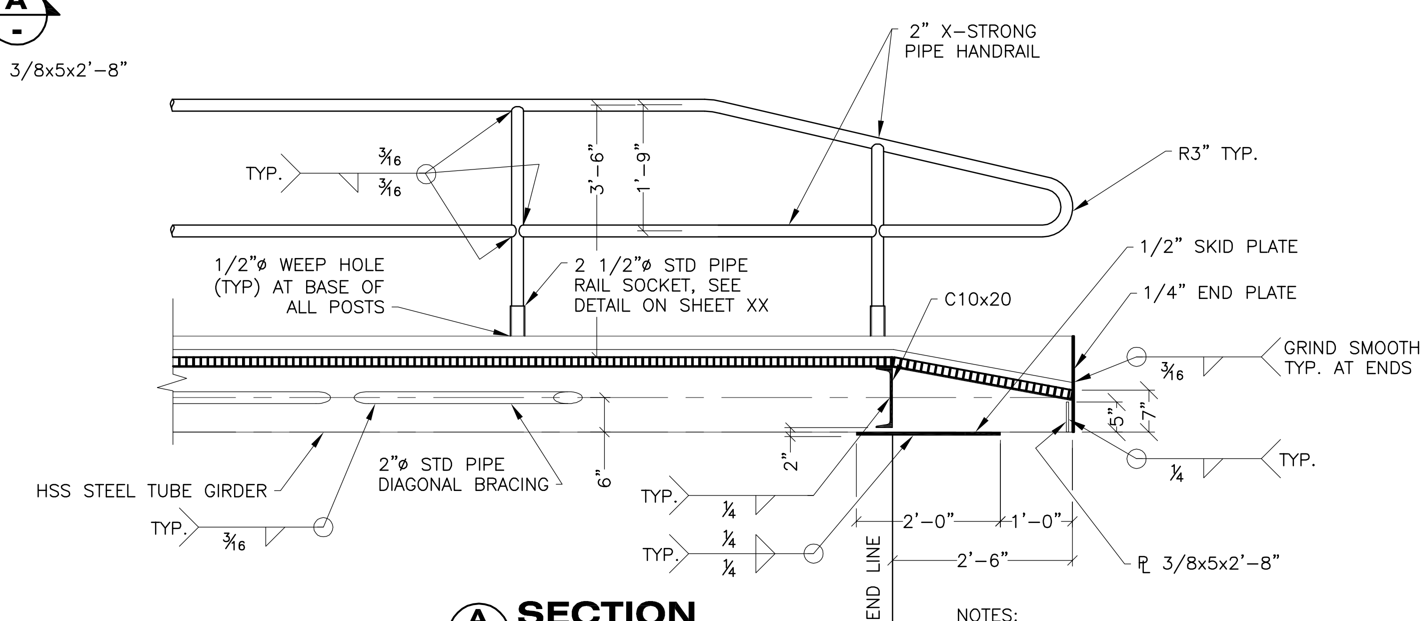
TYP CATWALK ELEVATION
RIGHT SIDE SHOWN



TYP END PLAN
DIMENSIONS SHOWN FROM CENTERLINE



TYPICAL SECTION
LOOKING FROM END A



A - SECTION

NOTES:
1. LIVE LOAD DEFLECTION LIMIT = L/360
2. PEDESTRIAN LIVE LOAD = 90 PSF

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TYPICAL CATWALK PLAN AND SECTION

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HEDGLIN, TOBY/SEA

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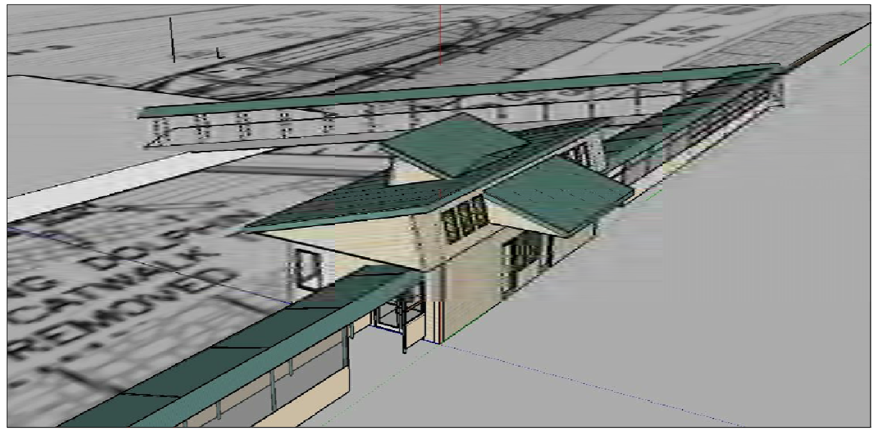
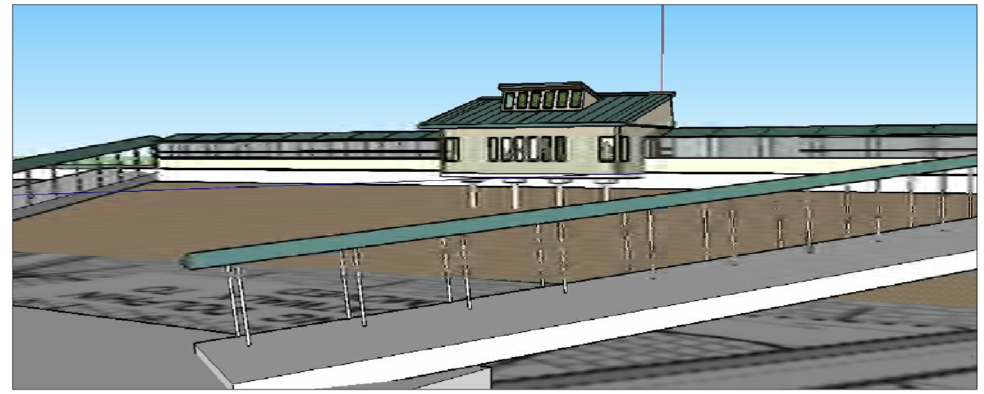


1 **BIRD'S EYE VIEW**



2 **FLOAT VIEW**

3 **LAND VIEW**

4 **OPEN END VIEW**

5 **INTERIOR VIEW**

6 **CUT VIEW**

PASSENGER WAITING BUILDING

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CHECKED BY: D. PLAYTER	
DRAWN BY: T. CHANCELLOR	

PATH: C:\PW_WORKDIR\DEN001\THEDGLIN\D0725122\16- ARCH - PASSENGER WAITING BLDG MODEL VIEWS.DWG
TAB: 16 Monday, August 01, 2016 3:34:52 PM HEDGLIN, TOBY/SEA

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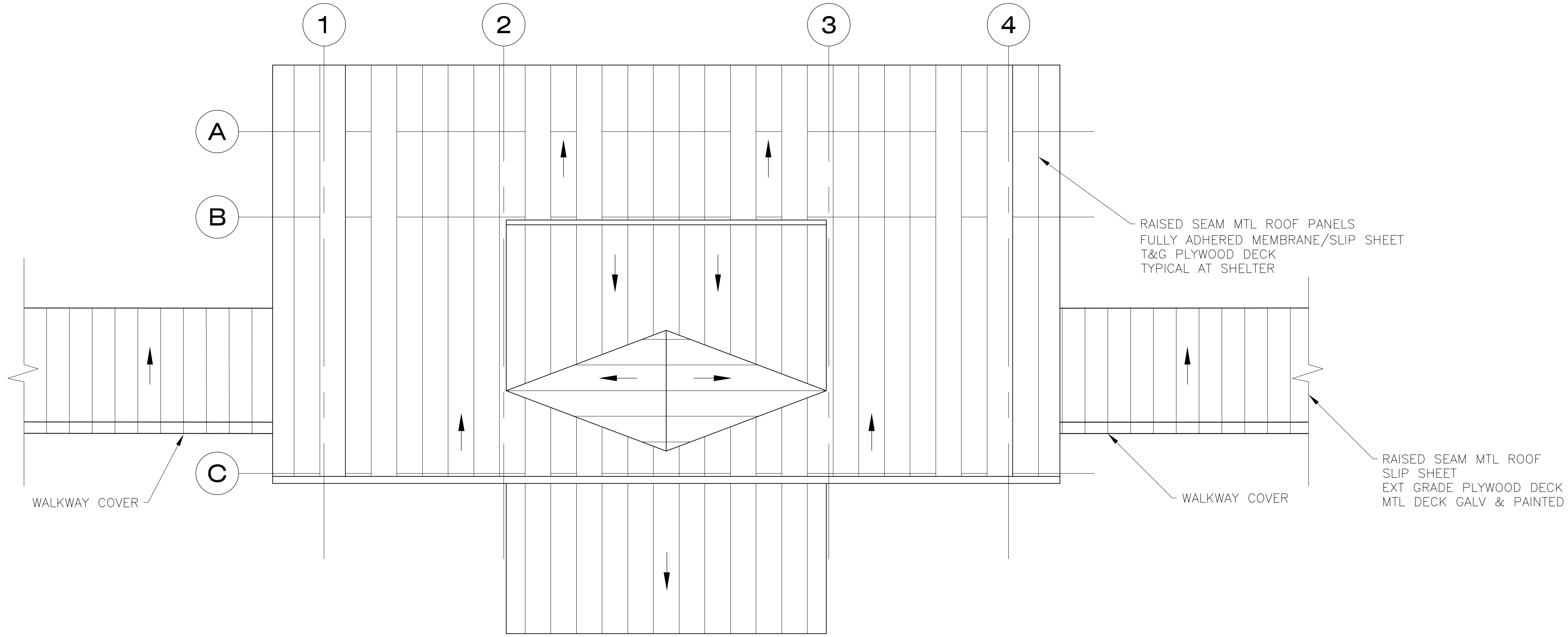
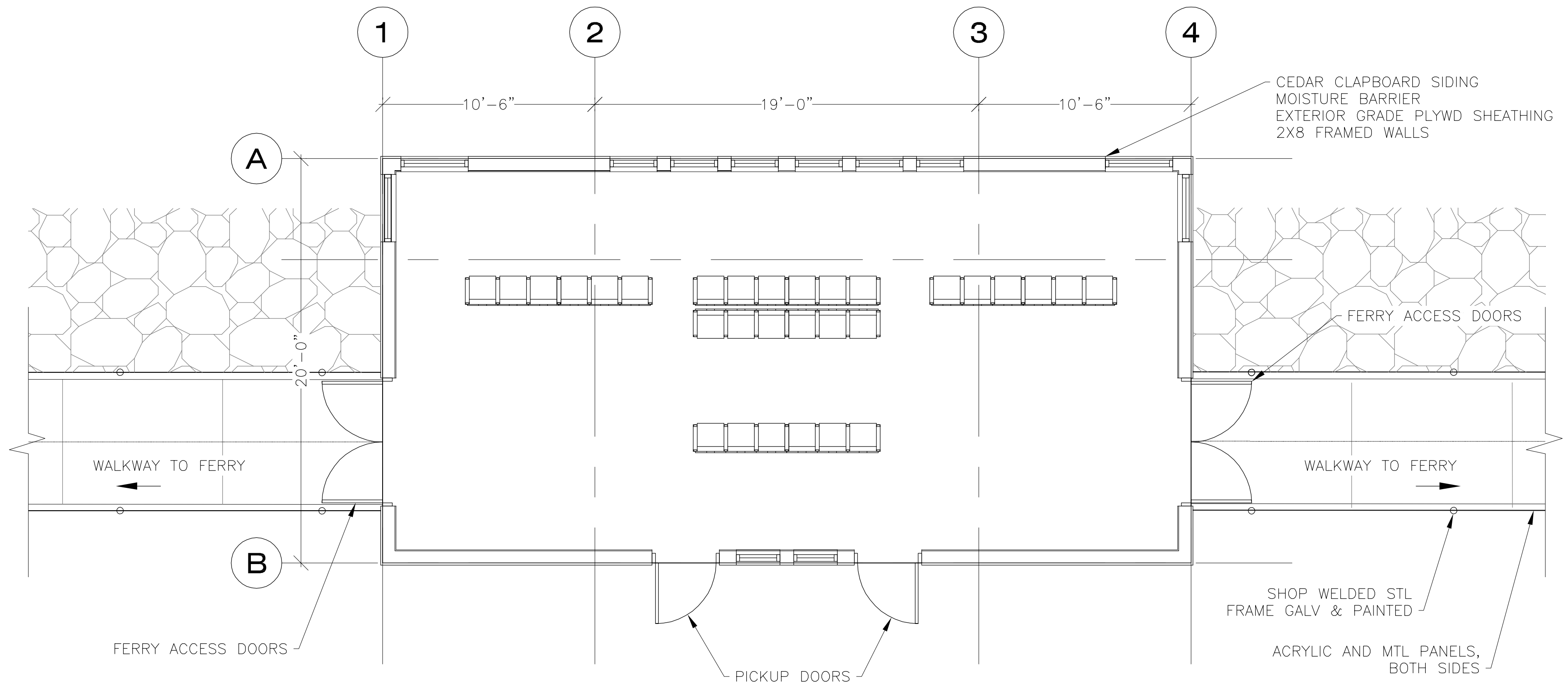


PASSENGER WAITING BUILDING ROOF PLAN



PASSENGER WAITING BUILDING FLOOR PLAN

DRAWING SCALES ARE FOR FULL-SIZE SHEETS. IF NO SCALE SHOWN, USE DIMENSIONS.

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PASSENGER WAITING SHELTER FLOOR AND ROOF PLANS

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TAB: 17 Monday, August 01, 2016 4:19:37 PM HEDGLIN, TOBY/SEA

REVISIONS			PROJECT DESIGNATION	YEAR	SHEET NO.	TOTAL SHEETS
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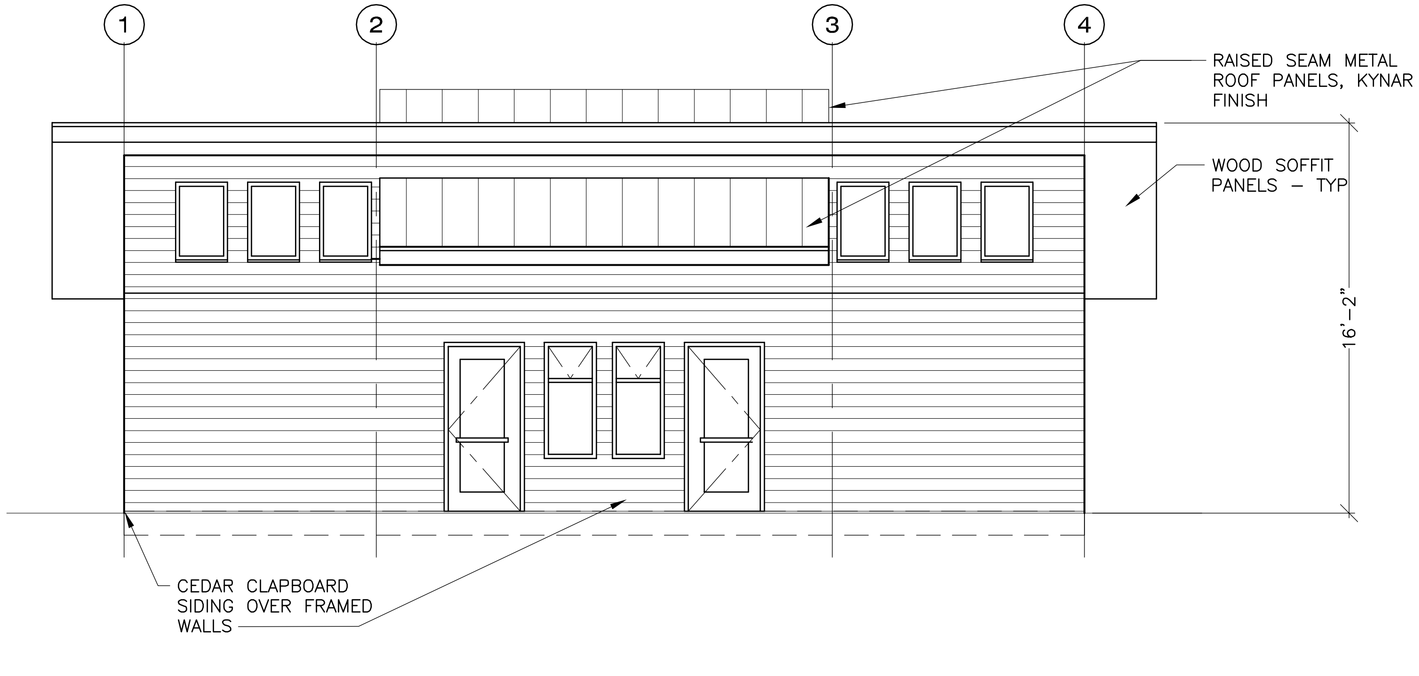
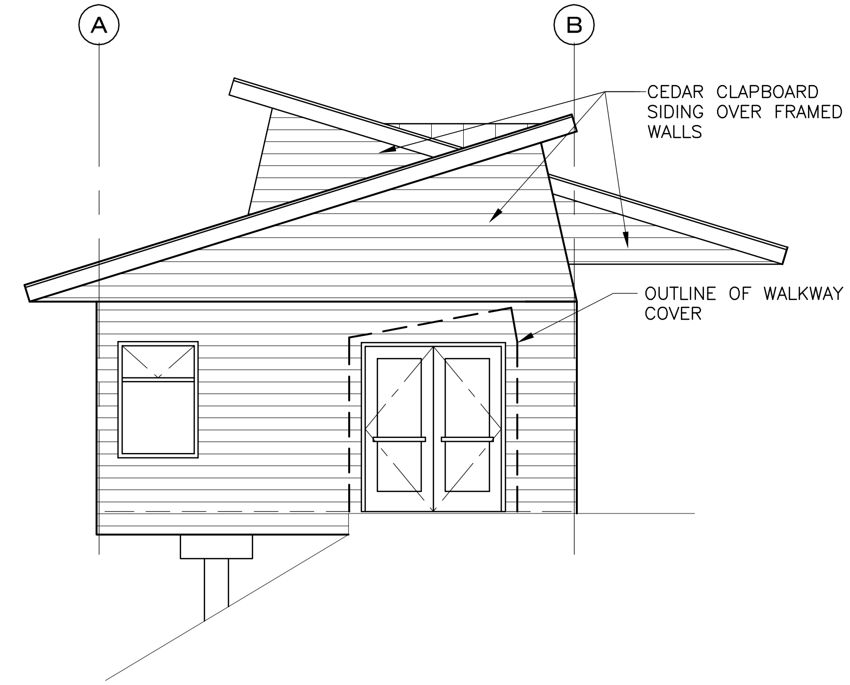


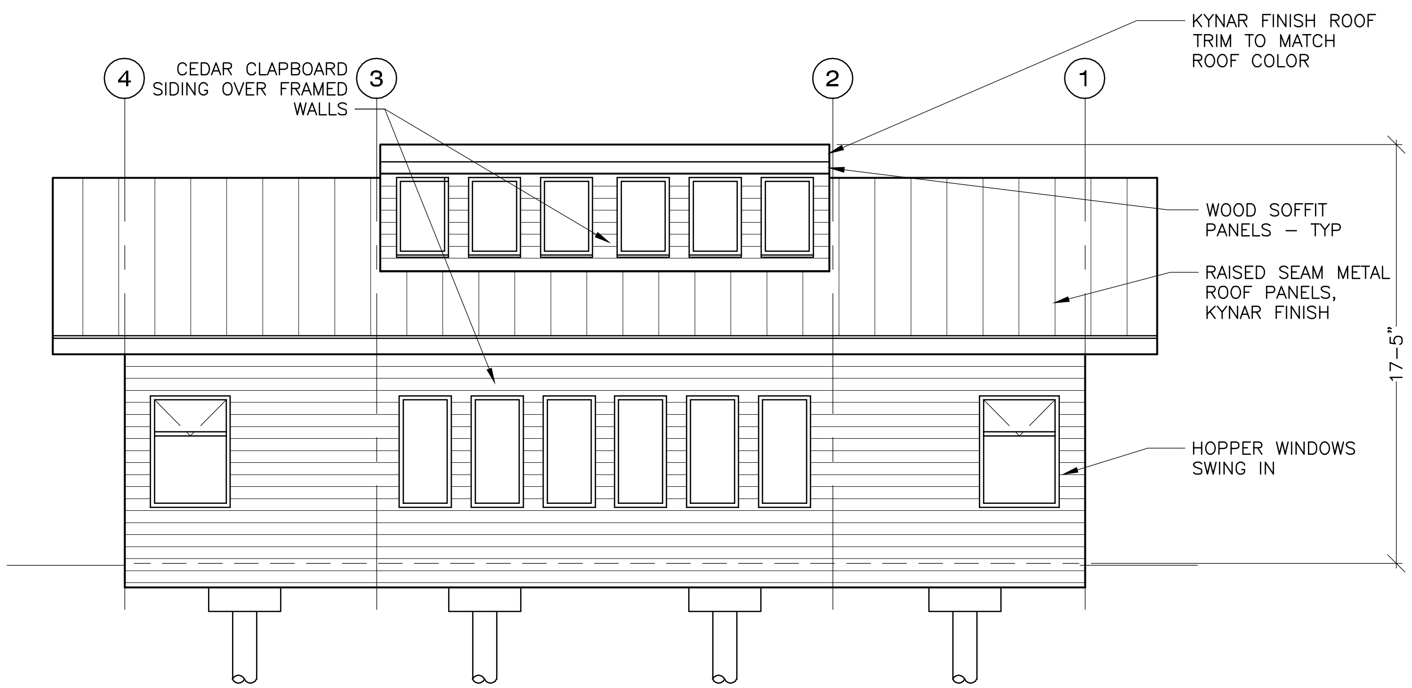
PASSANGER WAITING SHELTER - SOUTH ELEVATION

1/4" = 1'-0"



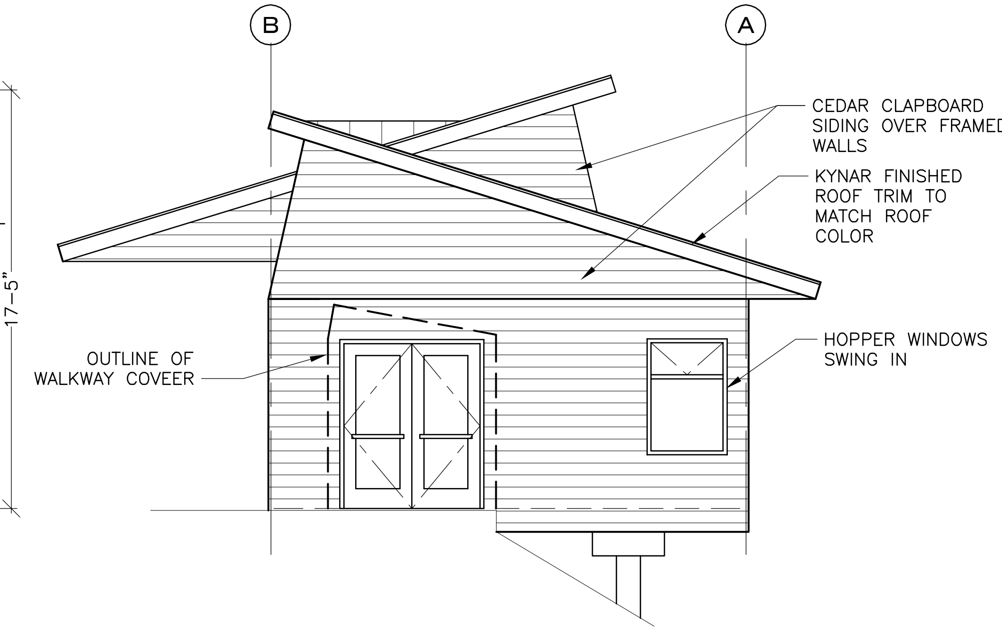
PASSANGER WAITING SHELTER - WEST ELEVATION

1/4" = 1'-0"



PASSANGER WAITING SHELTER - NORTH ELEVATION

1/4" = 1'-0"



PASSANGER WAITING SHELTER - EAST ELEVATION

1/4" = 1'-0"

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PASSENGER WAITING SHELTER ELEVATIONS

PATH: C:\PW_WORKDIR\DEN001\GBURLEY\D0725122\18- ARCH - PASSENGER WAITING BLDG ELEVATIONS.DWG

TAB: 18 Monday, August 01, 2016 5:10:27 PM BURLEY, GALE/SEA

REVISIONS			PROJECT DESIGNATION	YEAR	SHEET NO.	TOTAL SHEETS
NO.	DATE	DESCRIPTION	Z684640000/ 0955017	2016	18	18

Appendix B

Underwater Acoustics Theory and Formulae

JASCO 2017

Appendix B. Underwater Acoustics Theory and Formulae

B.1. Acoustics Metrics

Underwater sound pressure amplitude is measured in decibels (dB) relative to a fixed reference pressure of p_0 = 1 μPa. Because the perceived loudness of sound, especially impulsive noise such as from seismic airguns, pile driving, and sonar, is not generally proportional to the instantaneous acoustic pressure, several sound level metrics are commonly used to evaluate noise and its effects on marine life. We provide specific definitions of relevant metrics used in the accompanying report. Where possible we follow the ANSI and ISO standard definitions and symbols for sound metrics, but these standards are not always consistent.

The zero-to-peak sound pressure level, or peak sound pressure level (PK; dB re 1 μPa), is the maximum instantaneous sound pressure level in a stated frequency band attained by an acoustic pressure signal, $p(t)$:

$$L_{p,pk} = 20\log_{10}\left[\frac{\max\left(\left|p(t)\right|\right)}{p_0}\right] \tag{A-1}$$

$L_{p,pk}$ is often included as a criterion for assessing whether a sound is potentially injurious; however, because it does not account for the duration of a noise event, it is generally a poor indicator of perceived loudness.

The root-mean-square (rms) sound pressure level (SPL; dB re 1 μPa) is the rms pressure level in a stated frequency band over a specified time window (T, s) containing the acoustic event of interest. It is important to note that SPL always refers to an rms pressure level and therefore not instantaneous pressure:

$$L_p = 10\log_{10}\left(\frac{1}{T}\int_T p^2(t)dt \Big/ p_0^2\right) \tag{A-2}$$

The SPL represents a nominal effective continuous sound over the duration of an acoustic event, such as the emission of one acoustic pulse, a marine mammal vocalization, the passage of a vessel, or over a fixed duration. Because the window length, T, is the divisor, events with similar sound exposure level (SEL) but more spread out in time have a lower SPL.

In studies of impulsive noise, the time window T is often defined as the “90% time window” (T_{90}): the period over which cumulative square pressure function passes between 5% and 95% of its full per-pulse value. The SPL computed over this T_{90} interval is commonly called the 90% SPL (SPL(T_{90}); dB re 1 μPa):

$$L_{p90} = 10\log_{10}\left(\frac{1}{T_{90}}\int_{T_{90}} p^2(t)dt \Big/ p_0^2\right) \tag{A-3}$$

The sound exposure level (SEL, dB re 1 μPa^2·s) is a measure related to the acoustic energy contained in one or more acoustic events (N). The SEL for a single event is computed from the time-integral of the squared pressure over the full event duration (T):

$$L_E = 10\log_{10}\left(\int_T p^2(t)dt \Big/ T_0 p_0^2\right) \tag{A-4}$$

where T_0 is a reference time interval of 1 s. The SEL continues to increase with time when non-zero pressure signals are present. It therefore can be construed as a dose-type measurement, so the integration time used must be carefully considered in terms of relevance for impact to the exposed recipients.

Because the SPL(T_{90}) and SEL are both computed from the integral of square pressure, these metrics are related by the following expression, which depends only on the duration of the time window T:

$$L_p = L_E - 10\log_{10}(T) \quad \text{(A-5)}$$

$$L_{p90} = L_E - 10\log_{10}(T_{90}) - 0.458 \quad \text{(A-6)}$$

where the 0.458 dB factor accounts for the 10% of SEL missing from the SPL(T_{90}) integration time window.

B.2. Modeling Methods

B.2.1. Pile Driving Source Model

A physical model of pile vibration and near-field sound radiation was used to calculate source levels of piles. The physical model employed in this study computes the underwater vibration and sound radiation of a pile by solving the theoretical equations of motion for axial and radial vibrations of a cylindrical shell. These equations of motion are solved subject to boundary conditions, which describe the forcing function of the hammer at the top of the pile and the soil resistance at the base of the pile (Figure B-1). Damping of the pile vibration due to radiation loading is computed for Mach waves emanating from the pile wall. The equations of motion are discretized using the finite difference (FD) method and are solved on a discrete time and depth mesh.

In order to model the sound emissions of the piles, it was also necessary to model the force of the pile driving hammers. The force at the top of each pile was computed using the GRLWEAP 2010 wave equation model (GRLWEAP, Pile Dynamics 2010), which includes a large database of simulated hammers—both impact and vibratory—based on the manufacturer's specifications. The forcing functions from GRLWEAP were used as inputs to the FD model to compute the resulting pile vibrations.

The sound radiating from the pile itself is simulated using a vertical array of discrete point sources. The point sources are centred on the pile axis. Their amplitudes are derived using an inverse technique, such that their collective particle velocity—calculated using a near-field wave-number integration model—matches the particle velocity in the water at the pile wall. The sound field propagating away from the vertical source array is then calculated using a time-domain acoustic propagation model (Appendix B.3.1). MacGillivray (2014) describes the theory behind the physical model in more detail.

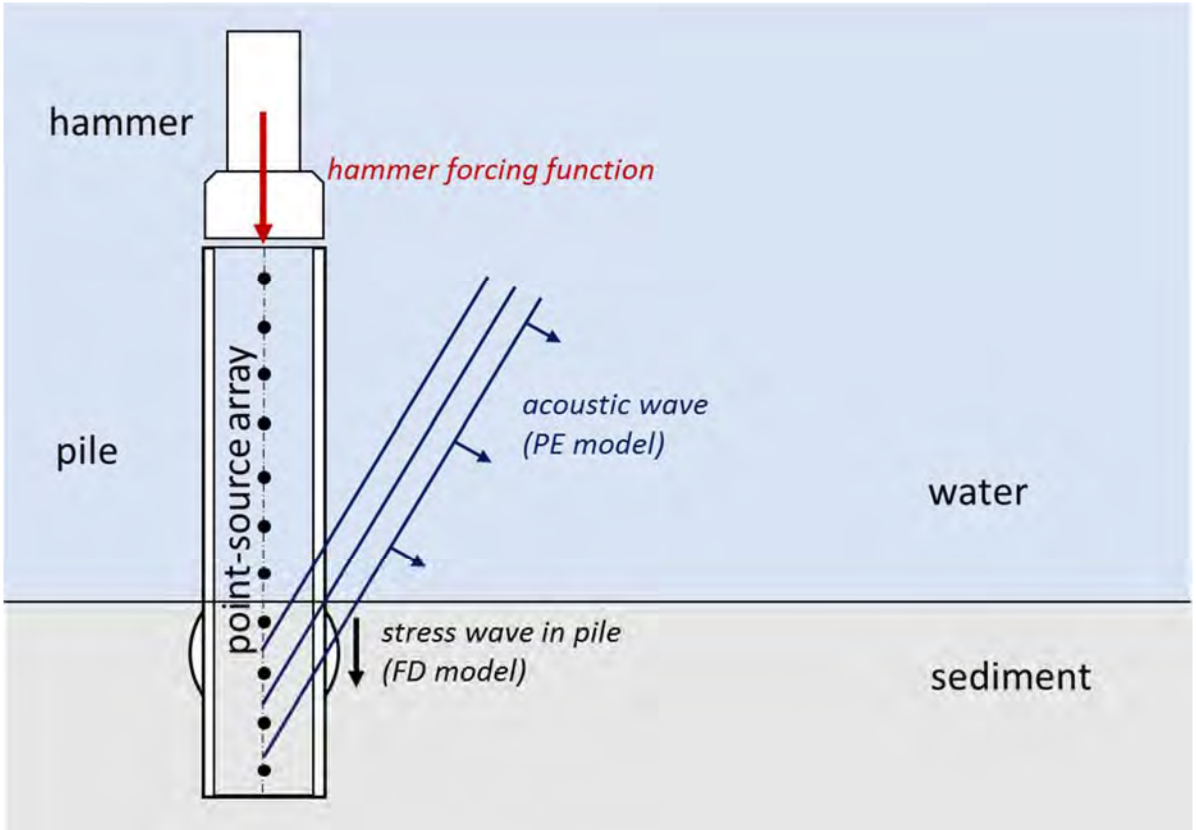

Figure B-1. Physical model geometry for impact driving of a cylindrical pile (vertical cross-section). The hammer forcing function is used with the finite difference (FD) model to compute the stress wave vibration in the pile. A vertical array of point sources is used with the parabolic equation (PE) model to compute the acoustic waves radiated by the pile wall.

B.3. Sound Propagation Model

B.3.1. Full Waveform Range-dependent Acoustic Model (FWRAM)

For impulsive sounds from impact pile driving, time-domain representations of the pressure waves generated in the water are required to calculate SPL and peak pressure level. Furthermore, the pile must be represented as a distributed source to accurately characterise vertical directivity effects in the near-field zone. For this study, synthetic pressure waveforms were computed using FWRAM, which is a time-domain acoustic model based on a version of the U.S. Naval Research Laboratory's Range-dependent Acoustic Model (RAM), which has been modified to account for a solid seabed (Zhang and Tindle 1995). FWRAM computes synthetic pressure waveforms versus range and depth for range-varying marine acoustic environments. FWRAM incorporates the following site-specific environmental properties: a bathymetric grid of the modeled area, underwater sound speed as a function of depth, and a geoacoustic profile based on the overall stratified composition of the seafloor. FWRAM computes pressure waveforms via Fourier synthesis of the modeled acoustic transfer function in closely spaced frequency bands. It employs the array starter method to accurately model sound propagation from a spatially distributed source (MacGillivray and Chapman 2012).

Synthetic pressure waveforms were modeled over the frequency range 10–1024 Hz, inside a 1 s window (Figure B-2). The synthetic pressure waveforms were post-processed, after applying a travel time correction, to calculate standard SPL and SEL metrics versus range and depth from the source.

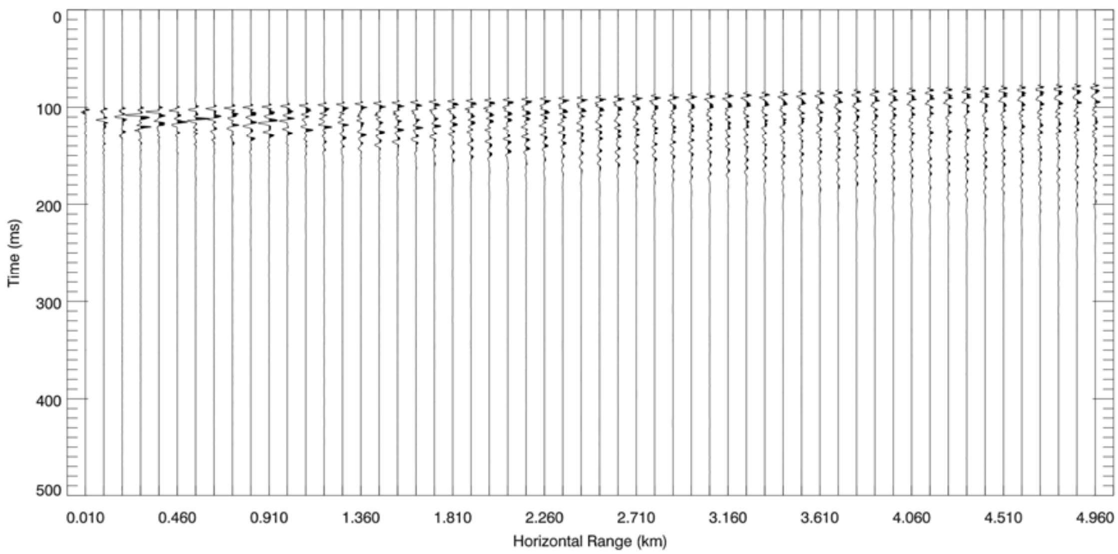

Figure B-2. Example of synthetic pressure waveforms computed by FWRAM for an unknown source. The pressure traces have been normalized for display purposes.

Appendix C

Ensonfied Area Maps

JASCO 2017

Figure 1 Thresholds to selected impact criteria for impact pile driving 30 in. diameter cylindrical steel pipes. The inset shows a close-up of sound fields around the pile location.

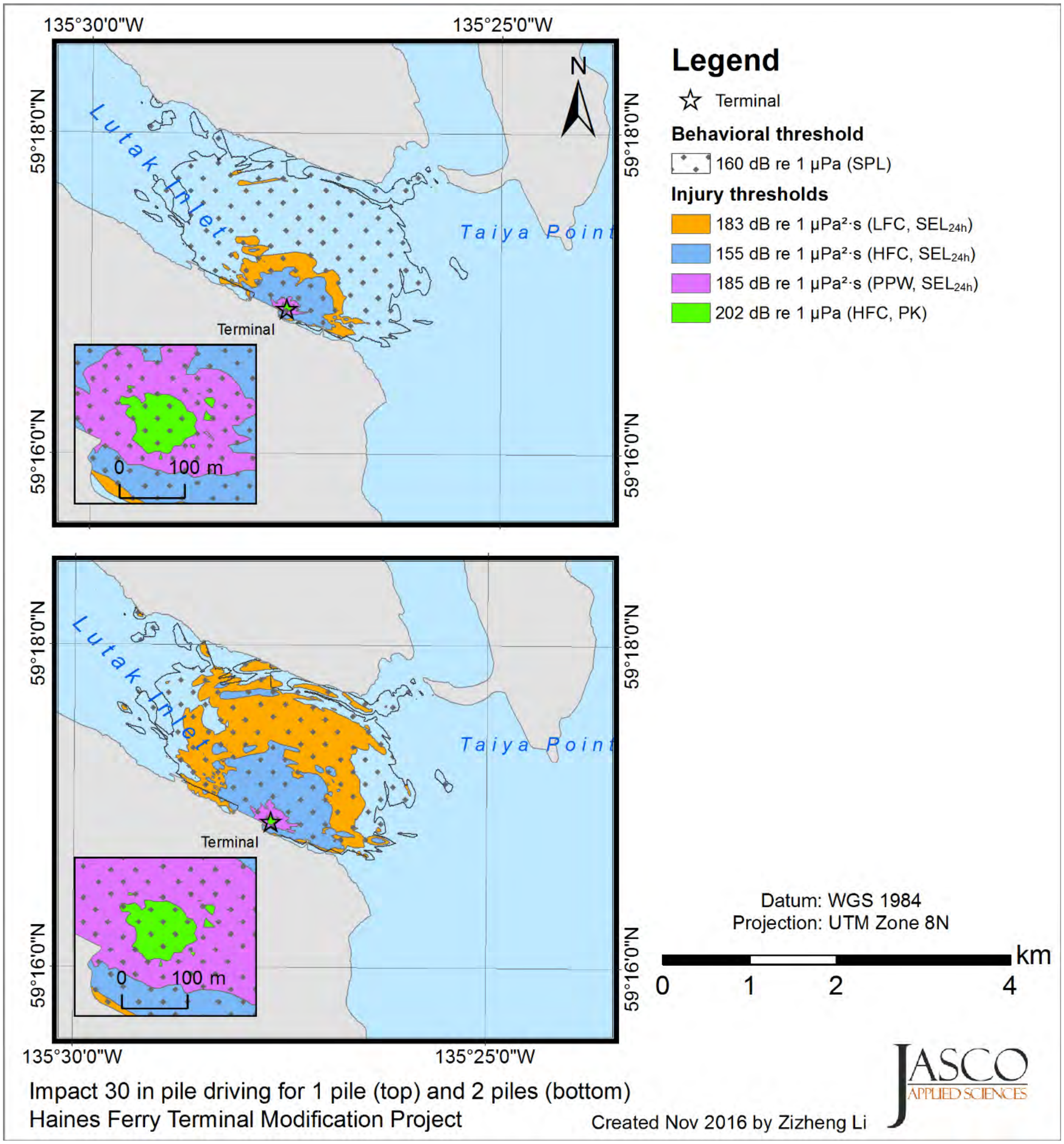

Figure 2 Thresholds to selected impact criteria for impact pile driving 36 in. diameter cylindrical steel pipes. The inset shows a close-up of sound fields around the pile location.

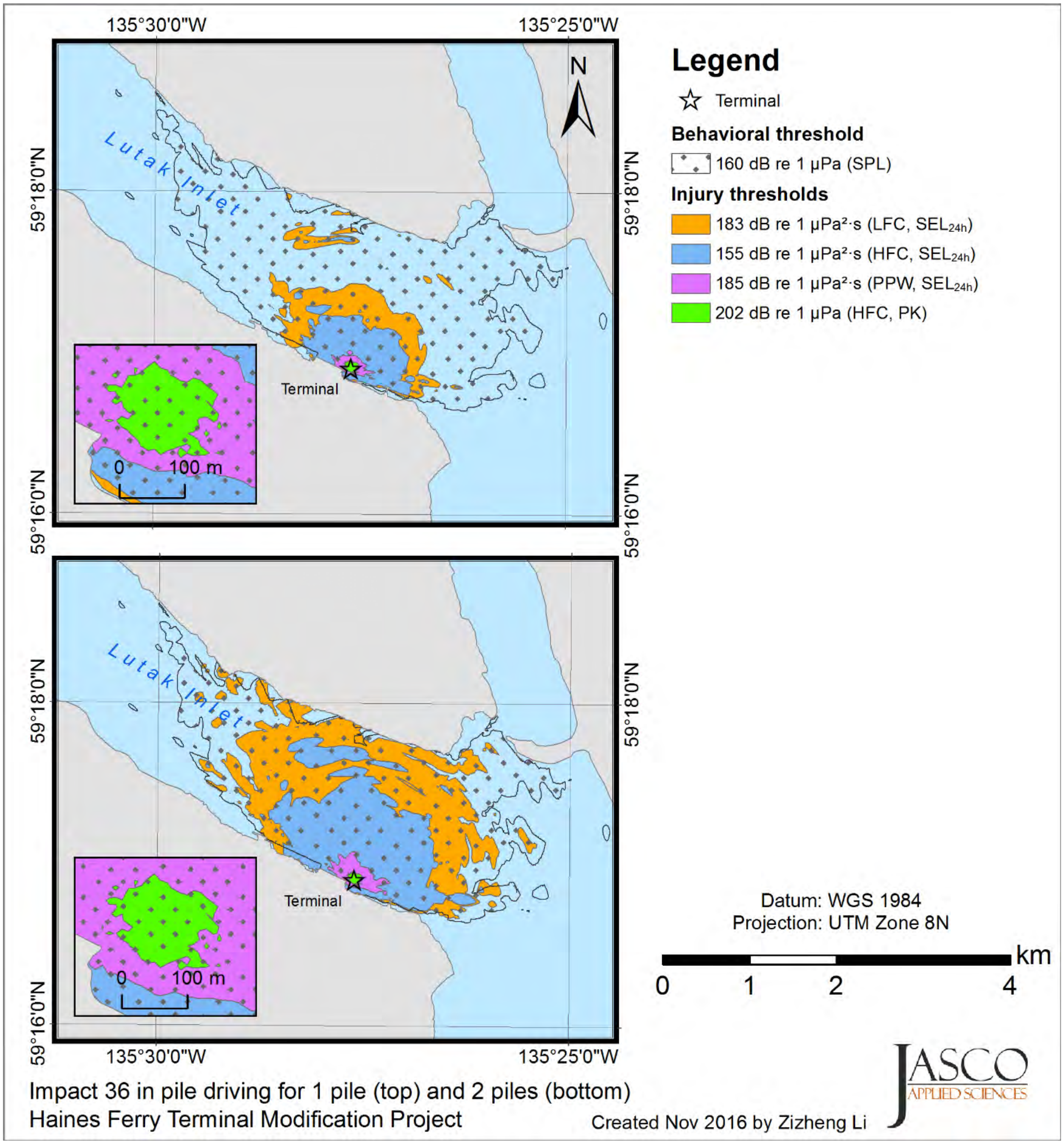

Figure 3 Thresholds to selected impact criteria for vibratory pile driving 30 and 36 in. diameter cylindrical steel pipes.