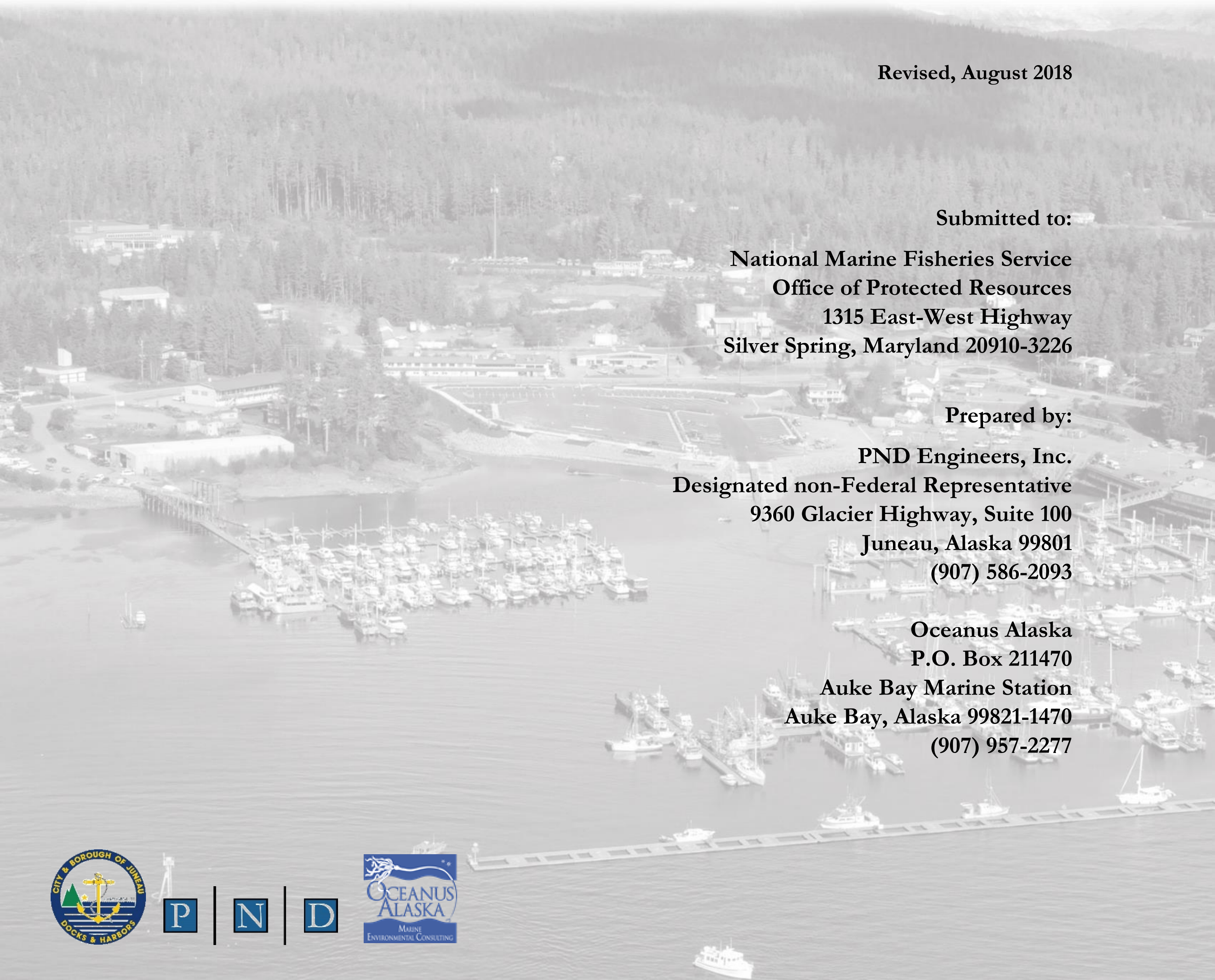
Request for an Incidental Harassment Authorization

Under the Marine Mammal Protection Act
for the

Statter Harbor Improvements Project Phase III A

City and Borough of Juneau, Alaska
Docks and Harbors Department



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ACRONYMS AND ABBREVIATIONS

- ABMS Auke Bay Marine Station
- ABTF Auke Bay Treatment Facility
- ADEC Alaska Department of Environmental Conservation
- ADF&G Alaska Department of Fish and Game
- ADNR Alaska Department of Natural Resources
- ASE Alaska Seismic and Environmental
- BMP best management practice
- CBJ City and Borough of Juneau
- D&H Docks and Harbors Department
- CFR Code of Federal Regulations
- CM cubic meters
- CWA Clean Water Act
- CV coefficient of variation
- CY cubic yards
- dB decibel
- DPS distinct population segment
- EA each
- eDPS Eastern Distinct Population Segment
- ESA Endangered Species Act
- FR Federal Register
- FRP fiber-reinforced polymer
- GPS global positioning system
- HTL high tide line
- Hz hertz
- IHA Incidental Harassment Authorization
- mDPS Mexico Distinct Population Segment
- MHW mean high water
- MLLW mean lower low water
- MMMP Marine Mammal Monitoring Plan
- MMPA Marine Mammal Protection Act
- MSE Mechanically Stabilized Earth
- NMFS National Marine Fisheries Service
- NOAA National Oceanic and Atmospheric Administration
- PND PND Engineers, Inc.
- POC plan of cooperation
- PTS permanent threshold shift
- RMS root mean square
- SEL Sound Exposure Level
- SEL_{CUM} Cumulative Sound Exposure Level
- SFT square feet
- SPAR Spill Protection and Response
- SPL sound pressure level
- SQM square meter

- SSL Steller Sea Lion
- TTS temporary threshold shift
- USACE United States Army Corps of Engineers
- USFWS United States Fish and Wildlife Service
- wDPS Western Distinct Population Segment
- WFA Weighting Factor Adjustment
- WSDOT Washington State Department of Transportation

1 Description of the Activity

1.1 Introduction

The City and Borough of Juneau Docks and Harbors Department (CBJ D&H) is proposing improvements to Statter Harbor within Auke Bay in Juneau, Alaska to improve safety, increase efficiency and reduce congestion. The proposed project will occur in marine waters that support several marine mammal species. The Marine Mammal Protection Act of 1972 (MMPA) prohibits the taking of all marine mammals, which is defined as to "harass, hunt, capture or kill, or attempt to harass, hunt, capture or kill," except under certain situations. Section 101(a)(5)(D) of the MMPA allows for the issuance of an Incidental Harassment Authorization (IHA), provided an activity results in negligible impacts to marine mammals and would not adversely affect subsistence use of these animals. The project may result in marine mammals protected under the MMPA being exposed to sound levels above allowable noise harassment or non-serious injury thresholds.

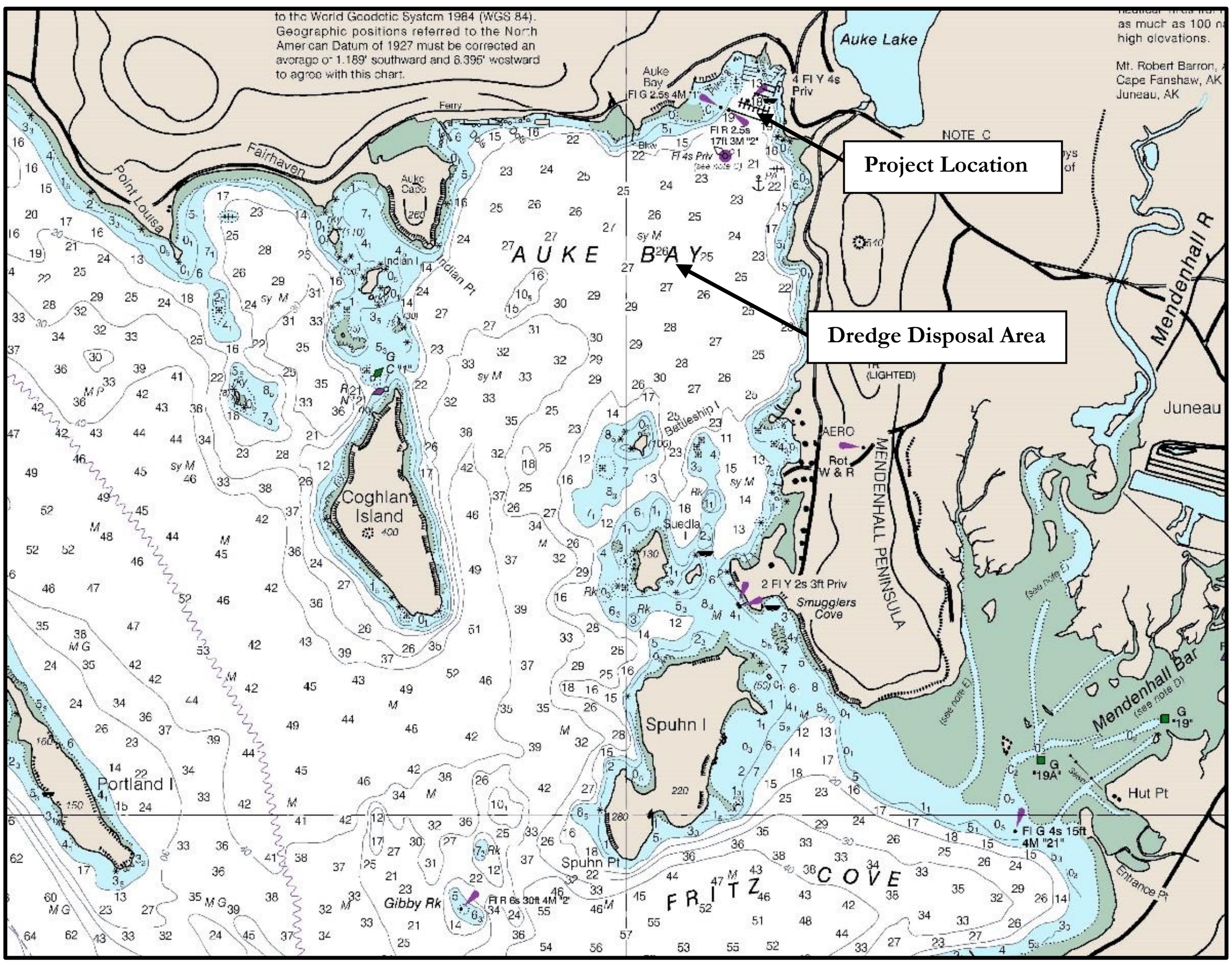

Figure 1. Vicinity Map

Figure 2. Statter Harbor

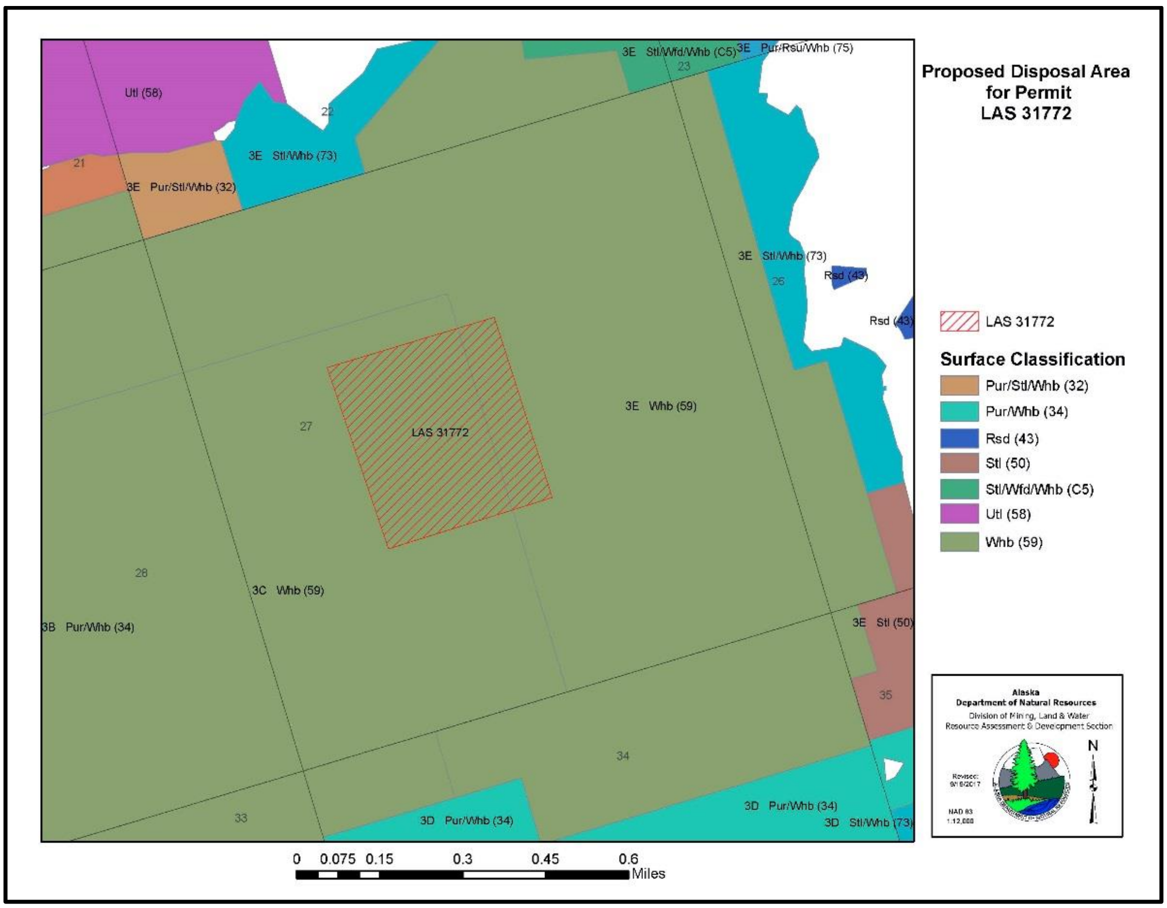

Figure 3. In-Water Dredge Disposal Map from ADNR Permit LAS 31772

1.2 Project Purpose and Need

The purpose of the proposed Statter Harbor Improvements Project is to improve safety, increase efficiency, and reduce congestion by incorporating of improvement plans identified in the Statter Harbor Master Plan. This can be achieved through safe access to the harbor, improving pedestrian access, reducing congestion and separating user groups.

Due to the harbor's location near a large population base and its popularity with locals, visitors and commercial operations, harbor use has increased steadily over the last two decades. Harbor infrastructure improvements are being made over the course of several phases to keep up with the harbor's diverse commercial and recreational users. Phase II of the Statter Harbor Improvements project has helped to increase harbor efficiency and decrease congestion. Phases III A and III B will continue the process of meeting the overall project purpose by separating user groups through adding charter floats and bus parking, to reduce congestion and increase the efficiency of operations in the harbor.

1.3 Project Description

The project will be constructed in phases. Phase III A includes demolition and disposal of the existing boat launch ramp and timber haulout pier, dredging of the planned harbor basin with offshore disposal, excavation of bedrock within the basin by blasting from a temporary fill pad, and construction of a mechanically stabilized earth (MSE) wall. The anticipated project quantities are shown in Table 1 and described in detail in the sections below.

Infrastructure to be installed in future phases includes new pile-supported concrete and timber floats, an aluminum gangway, and a kayak ramp.

This application covers work for Phase III A as described in detail below. See Section 4 for a detailed explanation and calculations supporting the determination of noise impacts and exclusion zones. Total project quantities are provided in Table 1, however work planned for Phases III B, III C, and IV is not discussed further. As an IHA can only be issued for one year, separate applications will be submitted as needed as construction continues in the future.

Because Statter Harbor is an active recreational and commercial harbor with high levels of noise and boat traffic, there is already a higher level of ambient noise within the area than in natural conditions. The mitigation measures and best management practices (BMP) that will be implemented are expected to reduce the project's impacts within the action area.

Table 1. Phases III and IV Project Quantities

Item	Size and Type, Location	Total Below HTL El. = 20.6 ft (6.3 m)
Phase III A		
Demolition and upland disposal of existing ramps, floats, and planks	Harbor Basin	3,392 SFT (315.1 SQM)
Existing Piles to be Removed	12.75-inch Steel; Boat Ramp	4 EA
	Timber; Boat Haulout	16 EA
Dredging	Dredge Basin 1.47 acres (0.59 hectares)	24,300 CY (18,578.7 CM)
Dredge Disposal[1]	Dredge Material; Dredge Disposal Area	30,375 CY (23,223.4 CM)
Temporary Fill for Blasting	4" Minus Shot Rock; Dredge Basin	12,500 CY (9,556.9 CM)
Bedrock Removal	Dredge Basin	2,000 CY (1,529.1 CM)
Surface Area of Water Filled	MSE Wall	5,850 SFT (543.5 SQM)
Armor Rock and Shot Rock	MSE Wall and Dredge Basin Armored Slopes	8,800 CY (6,728.1 CM)
Future Phases – III B, III B and IV		
Surface Area of Timber Floats	Phase III B Commercial Charter Floats	9,136 SFT (848.8 SQM)
Surface Area of Concrete Floats	Phase IV Permanent Moorage Floats	4,140 SFT (384.6 SQM)
Piles to be Installed	16-inch Steel Pipe; Commercial Charter Floats	20 EA
	24-inch Steel Pipe; Permanent Moorage Floats	6 EA
Kayak Ramp (Cubic Yards)	Concrete; Old Boat Launch Ramp	90 CY (68.8 CM)

[1] Dredge disposal volume is larger than dredged quantity due to bulking after the material has been removed. A bulking factor of 1.25 is supported by Bray *et al.* 1997, which cites this as an appropriate estimate for mechanically dredged silt and clay. Based on experience with other dredging projects, this bulking factor is likely conservative, which will ensure the entirety of the volume placed in the disposal area is accounted for.

1.3.1 Demolition and Disposal

Phase III A includes demolition and disposal of the existing 16-foot (4.9-meter) by 200-foot (61-meter) concrete boat launch ramp and planks, an 8-foot (2.4-meter) by 240-foot (73.2-meter) boarding float, four (4) 12.75-inch (3.2-decimeter) diameter steel pipe piles, 1,152 square feet (107.0 square meters) of timber boat haulout pier, and sixteen (16) 12-inch (3.7-meter) to 16-inch (4.9-meter) creosote-treated timber piles.

Demolition of the existing timber boat haulout pier and boat launch ramp will be performed with track excavators, loaders, cranes barges, crane dead-pulling (preferred method), vibratory hammer (if needed), various hand tools, and labor forces. Existing piles will be removed via dead-pulling with a crane if possible, or, if not, a vibratory hammer will be used. Vibratory pile removal will generally consist of clamping the vibratory hammer to the pile and vibrating the hammer while extracting to a point where the pile is temporarily secured and removal can be completed with crane line rigging under tension. The pile is then completely removed from the water by hoisting with crane line rigging and placing on the uplands or deck of the barge. The contractor will be required to dispose of demolished items in accordance with all federal, state, and local regulations.

1.3.2 Dredging and Dredge Disposal

The project includes 24,300 cubic yards (18,578.7 cubic meters) of dredging in the existing harbor. When the material is removed from the ground it will bulk up in the barge due to increased water content and fluff. To account for this a conservative bulking factor of 1.25 has been applied to the dredged volume, resulting in up to 30,375 cubic yards (23,223.4 cubic meters) of material to be disposed of.

A Sampling and Analysis Plan was developed for the dredge area and was implemented in October of 2016. The sample results indicated the material did not contain any contaminants above the regulatory screening levels and thus is suitable for in-water disposal. The U.S. Army Corps of Engineers (USACE) issued a determination of in-water suitability of disposal materials under POA-2008-782-M4.

Dredging will be performed by either an excavator or a crane with clamshell from a flat deck or derrick barge. The barge will be fixed in place to allow the excavator access to an area and periodically repositioned to gain access to new areas. Once material is removed from the seafloor, it will be placed into a second belly dump dredge barge where the material will dewater and then be towed by a tug to the disposal site to be deposited.

A disposal site for dredged material was selected as part of this study. The target location provided by the Alaska Department of Fish and Game (ADF&G) for the site (just outside of the harbor) was latitude 58° 22' 22.08" N and 134° 39'49.32" W. The USACE MPFate model was utilized to determine the barge release necessary to place the material within the target disposal location and to determine what the resulting mound may look like. Due to limitations and uncertainties in the MPFate model, an overall footprint of approximately 40 acres was conservatively determined and an additional 200-foot (61.0-meter) buffer added, resulting in a 65-acre (26.3-hectare) disposal site. Based on conversations with ADF&G, the goal was to minimize the disposal footprint as to the maximum extent. Figure 3 depicts the model iteration resulting in the smallest footprint able to be obtained considering the accuracy of the barge. In order for the material to situate in the specified disposal location, the barge release target location is 58° 22' 19" N, 134° 39' 58" W.

Detailed description of the modeling process was submitted to USACE with the application for disposal operations authorized under POA-2008-782-M4.

While the target release position for the barge can be specified, the actual disposal times and current conditions during disposal will vary depending on the contractor and site conditions. The coordinates for the corners of the proposed site are as follows:

Northwest corner: 58° 22' 30.37" N, 134° 40' 7.03" W
Northeast corner: 58° 22' 30.39" N, 134° 39' 35.64" W
Southeast corner: 58° 22' 12.64" N, 134° 39 '34.98" W
Southwest corner: 58° 22' 12.42" N, 134° 40' 5.82" W

1.3.3 Blasting and Excavation

A geotechnical investigation including borehole samples and test probing was performed by PND in 2016 and revealed shallow bedrock within the harbor basin. The design depth, necessary for safe navigation, is 16 feet (4.9 meters) below mean lower low water (MLLW) with an additional 1-foot (0.3-meter) overdredge allowance. Test probing showed that the top-of-rock elevations within the dredge basin range from approximately 4 feet below MLLW to depths greater than the design elevation (17 feet (5.2 meters) below MLLW with overdredge allowance).

During construction the dredging will be conducted first to remove the overburden from the bedrock. A survey will then be conducted to determine the exact extent of bedrock to be removed. The estimated amount of rock excavation is 1,761 cubic yards (2,000 cubic yards (1,529.1 cubic meters) permitted volume to account for uncertainty) based on preconstruction surveys. Temporary fill to confine the blast will be placed using conventional construction equipment. Approximately half of the fill for this temporary pad will be placed above the water line.

Alaska Seismic and Environmental prepared a General Blast Plan and Analysis and SPL and SEL Isopleth Distances report (Appendix D) detailing the bedrock removal plan and how the exclusion zones for each hearing group were determined. The selected methodology for the blast is two perform two blasts. Each blast will be approximately one (1) second in duration. Both blasts will consist of several detonations separated by millisecond delays. The number of charges will vary depending on conditions after overburden is removed but is anticipated to be between 50 and 75 holes per blast. Individual charge size will depend on conditions after holes are drilled; maximum charge size (explosive weight) detonated per 8-milliseconds delay period will be limited to 93.5 pounds (42.4 kilograms).

Individual charge amounts and other hole-loading details will be determined by the contractor's blaster-in-charge and blasting consultant after holes are drilled. This allows for safe and appropriate loading decisions to be made based on rock features such as voids, seams, fractures, and other discontinuities encountered during drilling.

After blasting, the temporary fill will be removed with excavators, loaded into dump trucks, and stockpiled in the uplands to be reused during the MSE wall construction. The blasted material will be excavated, separated from the temporary fill, and hauled offsite to an uplands disposal site.

1.3.4 MSE Wall

The MSE wall will be constructed with track excavators, loaders, vibratory drum rollers, dump trucks, various hand tools, and labor forces. Excavated material will be placed into dump trucks and hauled off-site. The concrete retaining wall blocks will be set in place one course at a time. Imported fill will be delivered by dump truck, spread behind the blocks in lifts, and compacted with vibratory rollers to meet design grades and compaction requirements. A layer of geotextile fabric will be placed behind the wall on the compacted fill with each course of blocks. A total of 6,800 cubic yards (5,199 cubic meters) of shot rock material will be placed below the HTL behind the MSE wall.

A 5-foot (1.5-meter) thick armored dredge basin slope will require an additional 650 cubic yards (497 cubic meters) of armor rock material, and a lower 2-foot (0.6-meter) thick slope will require an additional 1,350 cubic yards (1,032.1 cubic meters) of material. Total fill material placed below the HTL is not expected to exceed 8,800 cubic yards (6,728.1 cubic meters). Details of the fill materials are also included in the project drawings. All work in intertidal zones will be performed during low tides so that all material will be placed above current water levels.

2 Dates, Duration, and Region of Activity

2.1 Dates

Phase III A of the project is planned to occur between October 1, 2018 and May 1, 2019. CBJ D&H proposes to use the following general construction sequence, subject to adjustment by the construction contractor's means and methods:

Construction Phase III A (2018):

- Mobilization of equipment
- Demolition of boat launch and haulout
- Dredging and concurrent in-water dredge disposal
- Bathymetric survey to determine exact extent of bedrock to be removed
- Placement of temporary fill pad over ½ of blast site
- Blast #1
- Removal of temporary rock fill to second ½ of blast site
- Blast #2
- Removal of all blasted rock and temporary rock fill
- Disposal of blasted rock in uplands location
- Stockpiling of salvageable 4-inch minus shot rock from temporary fill
- Construction of MSE wall
- Demobilization of equipment

2.2 Duration

Work is expected to occur between October 1, 2018 and May 1, 2019. In winter months, shorter 8-hour to 10-hour workdays in available daylight are anticipated. To be conservative, 12-hour work days were used to analyze cumulative effects of construction noise in Section 4. The daily construction window for blasting and dredging will begin no sooner than 15 minutes after sunrise to allow for initial marine mammal monitoring to take place and will end 15 minutes before sunset to allow for pre-activity monitoring. (These protocols are discussed in detail in Section 11).

2.3 Region of Activity

The project site is located within Section 22, Township 40 South, Range 65 East of the Copper River Meridian; USGS Quad Map Juneau B-2; Latitude 58° 23' 6.99" North, 134° 38' 46.70" West; CBJ Tax Parcel ID 4B2801010032 and 4B2301050100, Legal Description A.T.S. 16 LT 3C and 739; in Juneau, Alaska. The proposed dredge disposal location is located within Section 27, Township 40 South, Range 65 East of the Copper River Meridian; USGS Quad Map Juneau B-2; centered at Latitude 58° 22' 19" North and Longitude 134° 39' 58" West; in Juneau, Alaska.

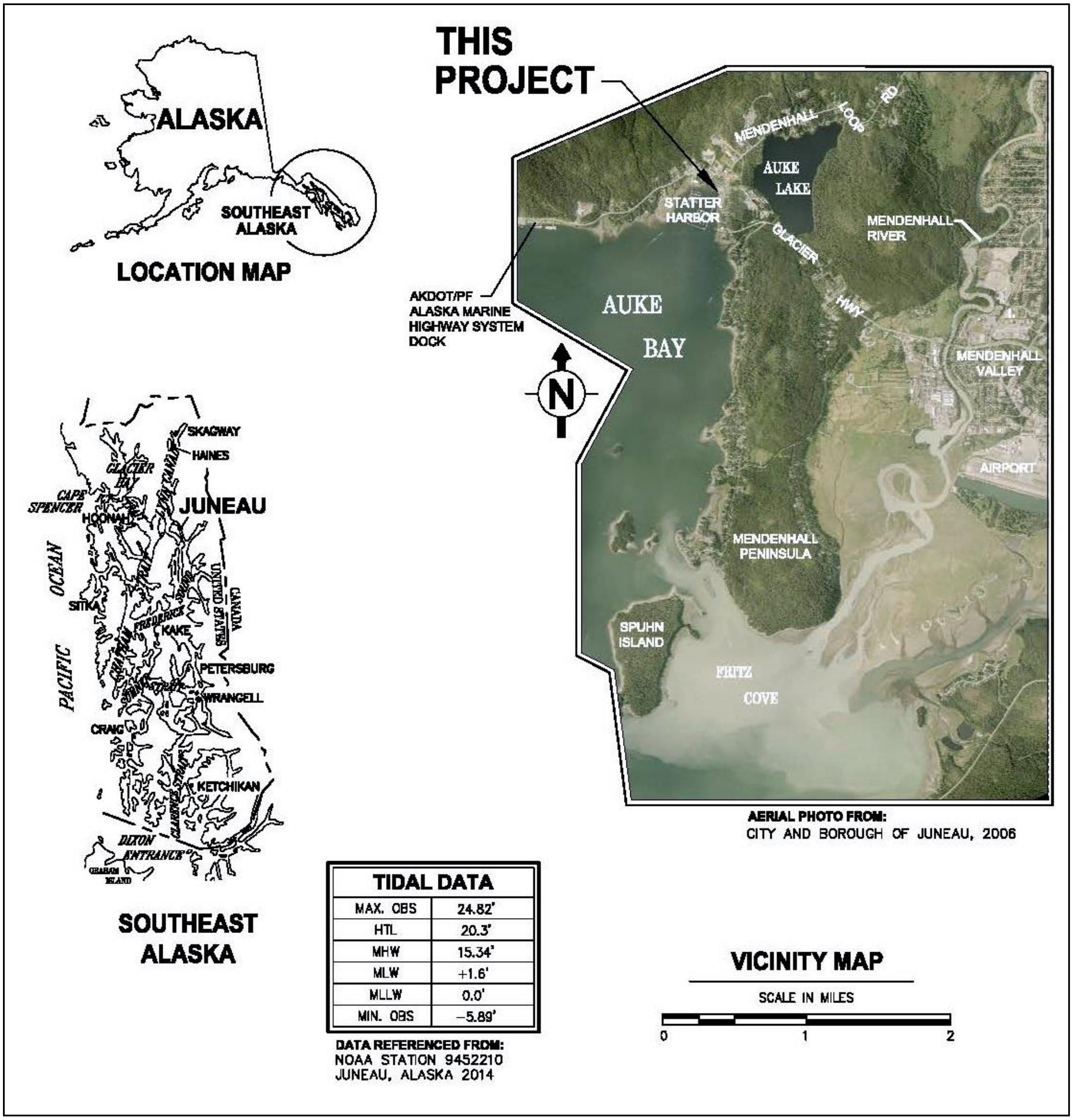

Figure 4. Region of Activity

3 Species and Number of Marine Mammals

Known distribution ranges of a number of marine mammal species, subspecies, or distinct population segments (DPSs) encompass the portion of Auke Bay in which the proposed project will occur. The species are listed in Table 2 along with their stock or population, their occurrence in the project area, and their estimated abundance. It is highly unlikely that several of these species will be observed in the project area due to the high volume of vessel traffic in and around Auke Bay.

Due to the low likelihood of sightings of Dall's porpoise, harbor porpoise, killer whale, California sea lion and the northern fur seal at the project site and within applicable impact zones; the humpback whale, Steller sea lion and harbor seal are the only species of concern within National Marine Fisheries Service (NMFS) jurisdiction that are included in this request. No further descriptions of the other marine mammals are included in this IHA application. Descriptions of the humpback whale, the Steller sea lion, and the harbor seal are provided in Section 4.

Two marine mammal species that are listed under the ESA and could potentially occur in the action area; the humpback whale and the Steller sea lion. There are two recently defined DPSs of humpback whales that may be in the project area during construction, but only the Mexico DPS is listed as threatened. The Hawaiian DPS is not listed as threatened or endangered. Both the eastern and western DPSs of Steller sea lions may be located within the project area. The eastern DPS (eDPS) is not listed and the western DPS (wDPS) is listed as endangered. The wDPS is less likely to be present in the project area during the proposed action construction season. The proposed project is not likely to jeopardize the continued existence of any threatened or endangered species or result in the destruction or adverse modification of habitat for these species. Critical habitat has not been designated in the action area.

Table 2. Species with ranges extending into the project site

Species	Estimated Abundance[1]/ Stock	MMPA Status	ESA Status	Occurrence In/Near Project During Winter
Humpback whale *(Megaptera novaeangliae)*	10,103 (Entire Central North Pacific Stock) [2]	Depleted, Strategic Stock	Threatened (Mexico DPS) & not listed	Intermittent
Steller sea lion (Eumetopias jubatus)	71,562 (Entire Eastern Stock)	Protected, Nonstrategic Stock	Delisted in 2013	Intermittent
	50,983 (Minimum estimate of Entire US Western Stock[3])	Depleted, Strategic Stock	Endangered	Rare
Harbor seal *(Phoca vitulina)*	9,478 (Lynn Canal/ Stephens Passage)	Protected, Nonstrategic Stock	NO	Common/Always present
Dall's porpoise *(Phocoenoides dalli)*	83,400 (Entire Alaska Stock)	Protected, Nonstrategic Stock	NO	Infrequent/Rare
Harbor porpoise *(Phocoena phocoena)*	975 (Southeast Alaska)	Protected, Strategic Stock	NO	Infrequent/Rare
Killer whale *(Orcinus orca)*	261 (Eastern North Pacific, Northern Residents)	Protected, Nonstrategic Stock	NO	Infrequent
	2,347 (Eastern North Pacific, Alaska Residents)			
	243 (West Coast Transients)			
California sea lion *(Zalophus californianus)*	153,337 (U.S. Stock)	Protected	NO	Very Rare
Northern fur seal *(Callorhinus ursinus)*	7,524 (California Stock)	Depleted	NO	Very Rare

[1] Abundance estimates are from the most recent published stock report (NOAA 2016).

[2] Humpback whales and Steller sea lions are discussed in terms of the Distinct Population Segments in the following sections to better quantify the effects to the endangered population segments.

[3] This is the minimum estimate for only the US portion of the wDPS. It is the minimum count because the counts were not corrected for animals at sea during the survey. The most recent estimates for the Russian portion of the wDPS is 12,700 non-pups and 6,021 pups. This results in a total abundance estimate of 90,283 including both pups and non-pups.

4 Affected Species Status and Distribution

This section describes the status, distribution, behavior, and critical habitat (ESA listed species only) for the affected species/stocks of marine mammals likely to be affected by the proposed project.

4.1 Humpback Whale (*Megaptera novaeangliae)*

4.1.1 Status

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

In the North Pacific, five DPSs were identified that breed in subtropical and tropical waters from Asia to Central America then migrate north to feed in highly productive North Pacific feeding grounds (Bettridge *et al.* 2015). Whales from three of these newly-defined DPSs migrate to Alaskan waters: the Mexico DPS (mDPS) (ESA-listed as threatened), the Western North Pacific DPS (ESA-listed as endangered), and the Hawaii DPS (not listed under the ESA) (81 FR 62260).

4.1.2 Distribution

The humpback whale is distributed worldwide in all ocean basins. Relatively high densities of humpback whales are found in feeding grounds in Southeast Alaska and northern British Columbia, particularly during summer months. Based on extensive photo identification data, NMFS has determined that individual humpback whales encountered in Southeast Alaska and northern British Columbia have a 93.9% probability of being from the recovered (not ESA-listed) Hawaii DPS (CV= 0.17) and a 6.1% probability of being from the threatened (ESA-listed) Mexico DPS (CV= 0.03). There is a 0% probability that humpback whales in Southeast Alaska are from the endangered Western North Pacific or Central America DPS (Wade *et al.* 2016). Intermixing humpbacks are not visually distinguishable; their identity can only be determined by DNA or photo identification. Therefore, we will use Wade *et al.* (2016) estimates to assume 93.9% of humpbacks in Southeast Alaska are from the Hawaii DPS and 6.1% are from the Mexico DPS.

Humpbacks migrate to Alaska to feed after months of fasting in low latitude breeding grounds. The timing of migration varies among individuals: most humpbacks begin returning to Alaska in spring and most depart Alaska for southern breeding grounds in fall or winter. Peak numbers of humpbacks in Southeast Alaska occurs during late summer to early fall. But, because there is significant overlap between those whales departing and returning, humpbacks can be found in Alaska feeding grounds in every month of the year (Baker *et al.* 1985, Straley 1990, Wynne and Witteveen 2009). There is also an apparent increase in the number of humpbacks overwintering in feeding grounds in Alaska (Straley *et al.* 2017).

4.1.2.1 Hawaii Distinct Population Segment Humpback Whale (Hawaii DPS)

Humpbacks that breed around the main Hawaiian Islands have been observed in summer feeding grounds throughout the North Pacific. The majority of the Hawaii DPS migrates to feeding grounds in Southeast Alaska and northern British Columbia (Bettridge *et al.* 2015). Mark-recapture analysis of identification photographs suggests the Hawaii DPS numbers approximately 10,000 individuals and is increasing (Calambokidis *et al.* 2008). A multi-strata analysis estimated the abundance of the Hawaii DPS as 11,398 individuals (CV=0.04) (81 FR

62260). Wade *et al.* (2016) estimated that 93.9% of the humpbacks encountered in Southeast Alaska and Northern British Columbia are from the Hawaii DPS.

4.1.2.2 Mexico Distinct Population Segment Humpback Whale (mDPS)

Whales in the mDPS typically breed offshore of the Revillagigedo Islands in Mexico and migrate to northern feeding grounds ranging from British Columbia to the western Gulf of Alaska. Given their widespread range and their opportunistic foraging strategies, mDPS humpback whales may be in the vicinity during the proposed project activities. In the final rule changing the status of humpback whales under the ESA (81 FR 62260), the abundance of the mDPS was estimated to be 3,264 individuals (CV= 0.06) with an unknown trend. Note that only a portion of the mDPS migrates to Alaska for feeding; the probability that a whale in Southeast Alaska and northern British Columbia is from the mDPS is 6.1% (Wade *et al.* 2016).

Because humpback whale individuals of different DPS (natal) origin are indistinguishable from one another (unless fluke patterns are linked to the individual in both feeding and breeding ground), the frequency of occurrence of animals by DPS is only *estimated* using the DPS ratio, based upon the assumption that the ratio is consistent throughout the Southeast Alaska region (Wade *et al.* 2016).

4.1.2.3 Critical Habitat

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

4.1.3 Statter Harbor Area

Humpback whales occur in the project area intermittently year-round. It appears that Auke Bay (and even Statter Harbor) provides some attractive habitat features for some whales – at least in recent years. The aggregation of herring in inner Auke Bay provide a habitat where whales may make energetic decisions to exploit small volumes of fish and rest to conserve energy between foraging opportunities. Section 6.1 discusses occurrences of humpback whales in the project vicinity.

4.1.4 Reproduction and Breeding

During the winter months most Humpback whales make a long annual migration to the low-latitude subtropical and tropical waters to breed and calve (Kennedy *et al.* 2014). Humpback whales do not breed or calve in Alaska waters and individuals of the central north pacific stock primarily migrate to Hawaii for breeding and calving (Muto *et al.* 2017).

4.1.5 Foraging

While in their Alaskan feeding grounds, humpback whales prey on a variety of euphausiids and small schooling fishes including herring, smelt, capelin, sandlance, juvenile pollock, and salmon smolts (Nemoto 1957, Kawamura 1980, Krieger and Wing 1986, Witteveen *et al.* 2008, Straley *et al.* 2017, Chenoweth *et al.* 2017). Herring targeted by Southeast Alaska whales in Lynn Canal during 2007-2009 winters were lipid-rich, with energy content ranging from 7.3 – 10.0 kJ/gram (Vollenweider *et al.* 2011). The local distribution of humpbacks in Southeast Alaska appears to be correlated with the density and seasonal availability of prey, particularly herring and euphausiids (Moran *et al.* 2017). Important feeding areas include Glacier Bay and adjacent portions of Icy Strait, Stephens Passage/Frederick Sound, Seymour Canal, Lynn Canal, and Sitka Sound. During autumn and winter, the non-breeding season, humpbacks remaining in Southeast Alaska target areas where herring and eulachon are abundant, such as Seymour Canal, Berners Bay, Auke Bay, Lynn Canal, and Stephens Passage (Krieger and Wing 1986, Moran *et al.* 2017). Over 2,940 and 2,019 humpback whale foraging-days were documented in Lynn Canal alone in 2007-2008 and 2008-2009 winter seasons, respectively (Moran *et al.* 2017).

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

4.1.6 Hearing Ability

Humpback whales live in an acoustic world. Humpbacks produce a variety of vocalizations ranging from 20 Hz to 10 kHz to locate prey, coordinate communal feeding efforts, attract mates, and for mother-calf communication (Winn *et al.* 1970, Au *et al.* 2006, Vu *et al.* 2012). NMFS categorizes humpback whales in the low-frequency cetacean functional hearing group, with an applied frequency range between 7 Hz and 35 kHz (NMFS 2016). Depending on its strength and duration, anthropogenic noise can result in social disturbance, physical discomfort, and masking of intraspecific humpback communication. Although difficult to detect visually, evidence that individual humpbacks are responding to elevated noise levels has been inferred by whales leaving/avoiding ensonified areas and reducing the duration and frequency of intraspecific vocalizations (NRC 2005, Nowacek *et al.* 2007). Humpback whales use singing as a form of underwater communication at their wintering grounds for mating and seasonally at feeding grounds, like the Aleutian Islands. Loud underwater noises, such as those from seismic surveys and pile driving, can result in humpback whales adjusting their acoustic behavior in ways like altered song length (Fleming and Jackson 2011).

4.2 Steller Sea Lion (*Eumetopias jubatus*)

4.2.1 Status

The Steller sea lion was listed as a threatened species under the ESA in 1990 following declines of 63% on certain rookeries since 1985 and declines of 82% since 1960 (55 FR 12645). In 1997, two DPSs of Steller sea lion were identified based on differences in genetics, distribution, phenotypic traits, and population trends (Fritz *et al.* 2013, 62 FR 24345).

In 2014 Steller sea lions had a worldwide population estimated at 142,360-157,498 animals (Allen and Angliss 2014). The Eastern DPS (eDPS) population counts continued to increase during the same period and was removed from ESA listing in 2013 (78 FR 66140). The eDPS of Steller Sea Lions is protected under the MMPA but is not a strategic or depleted species. The Western DPS (wDPS) is listed as endangered under the ESA and is a depleted, strategic stock under the MMPA. (Muto *et al.* 2017)

4.2.1.1 Eastern DPS

The eDPS stock is commonly found in the project area waters and were most recently surveyed in Southeast Alaska in June-July of 2015. The current population estimate for the eDPS stock is 71,562 individuals of which 52,139 are non-pups and 19,423 are pups. In Southeast Alaska the estimated total abundance is 28,594 individuals of which 20,756 are non-pups and 7,838 are pups. The eDPS has been increasing between 1990 to 2015 with an estimated annual increase of 4.76% for pups and 2.84% for non-pups. (Muto *et al.* 2017)

4.2.1.2 Western DPS

The wDPS stock is found infrequently in the project area waters, however do occur rarely. The current abundance estimate for the US portion of the wDPS is 50,983 of which 12,492 were pups and 38,491 were non-pups. This is the minimum estimate for only the US portion of the wDPS. It is the minimum count because the counts were not corrected for animals at sea during the survey. The most recent estimates for the Russian portion of the wDPS is 12,700 non-pups and 6,021 pups. This results in a total abundance estimate of 90,283 including both pups and non-pups. The overall trend for the wDPS in Alaska is an annual increase of 1.94% for non-pups and 1.87% for pups. (Muto *et al.* 2017)

4.2.2 Distribution

Steller sea lions range throughout the North Pacific Ocean from Japan, east to Alaska, and south to central California (Loughlin *et al.* 1984). They range north to the Bering Strait, with significant numbers at haulouts on St. Lawrence Island, Alaska in the spring and fall (Sheffield and Jemison 2012). Their range extends around the North Pacific Ocean rim, with most sea lions occupying either rookeries or haulouts, depending on the season. Male sea lions are more likely to disperse beyond their typical habitat, but this primarily occurs after the breeding season (NMFS 2008).

The wDPS generally occurs west of Cape Suckling, and the eDPS generally occurs east of Cape Suckling, Alaska (144° W longitude). The centers of abundance and distribution for the Western DPS are located in the Gulf of Alaska and Aleutian Islands.

The geographic and genetic interplay between the wDPS and the eDPS needs to be understood in order to gauge potential project impacts in the action area on the endangered wDPS. Large movements by individual Steller sea lions on either side of the 144° W longitude demarcation have occurred, and wDPS individuals have been documented in Southeast Alaska, especially north of Sumner Strait (Jemison *et al.* 2013, Fritz pers. comm. 2017). Most Steller sea lions in the action area are expected to be from the eDPS but wDPS animals also inhabit these waters, as detailed below (Jemison *et al.* 2013). However, it is not possible to visually distinguish between the two DPSs without brandings.

Although recent data in the northern part of the eastern DPS indicate movement of western sea lions east of the 144° line, the mixed part of the range remains small (Jemison *et al.* 2013) and the overall discreteness of the eDPS from the wDPS remains distinct.

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

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

4.2.2.1 Critical Habitat

There is no critical habitat designated for Steller sea lions within the action area. The action area is located approximately 12 nautical miles (22.22 kilometers) from around Benjamin Island, well outside of the 3,000-foot (914.4-meter) designated critical habitat (Figure 5).

4.2.3 Statter Harbor Area

Steller Sea Lions occur intermittently in the project area. Based on observations by ADF&G over the last decade this project is unlikely to impact wDPS individuals, however to be conservative this application does consider the small number of wDPS individuals which may be present in the project area as further discussed in Section 6.2.

4.2.4 Reproduction and Breeding

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

4.2.5 Foraging

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

Their diet may vary seasonally depending on the abundance and distribution of prey. Womble *et al.* (2009) found that "a reasonable annual foraging strategy for Steller sea lions is to forage on herring (*Clupea pallasii*) aggregations in winter, spawning aggregations of forage fish in spring, salmon (*Oncorhynchus spp.*) in summer and autumn, and pollock (*Theragra chalcogramma*) and Pacific hake (*Merluccius productus*) throughout the year." They may disperse and range great distances to find aggregated prey but are not known to migrate. Steller sea lions can dive to approximately 1,300 feet (400 meters) in depth to exploit deep prey resources.

4.2.6 Hearing Ability:

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

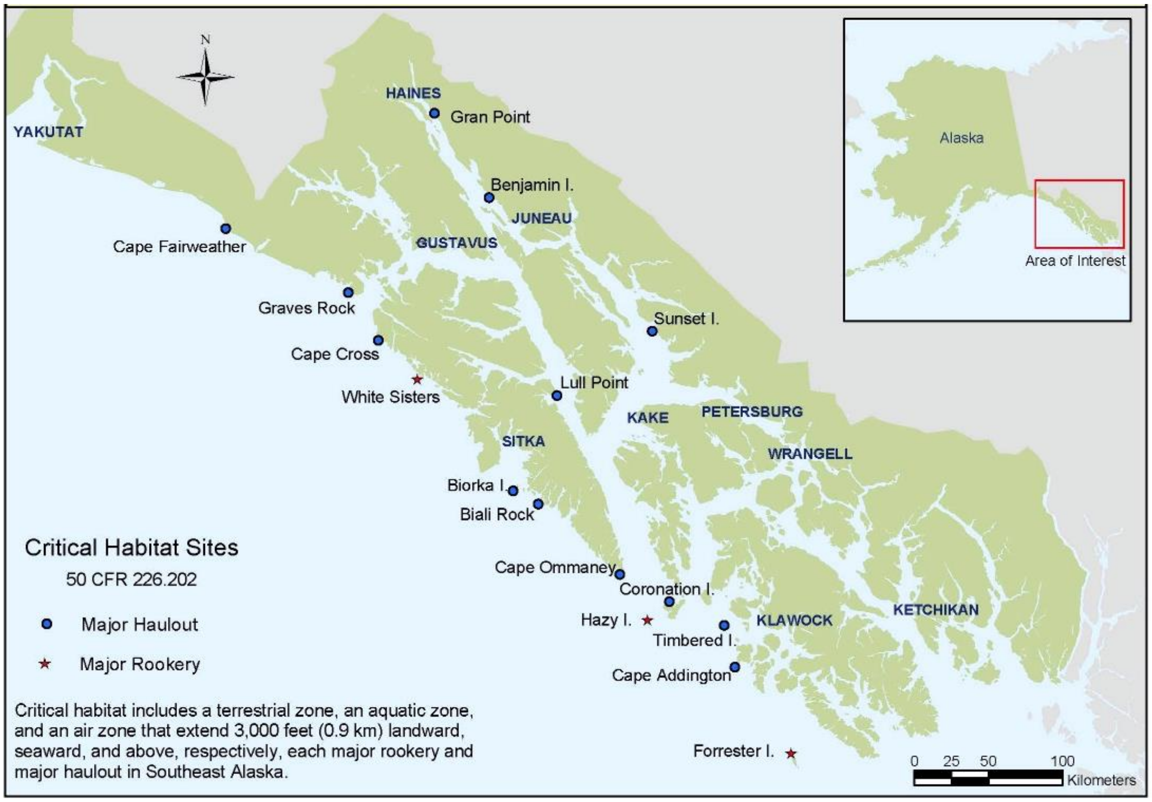

Figure 5. Steller Sea Lion Critical Habitat Sites

4.2.6.1 Steller Sea Lion Critical Habitat

There is no critical habitat designated for Steller sea lions within the action area. The action area is located approximately 12 nautical miles (22.22 kilometers) from around Benjamin Island, well outside of the 3,000-foot (914.4-meter) designated critical habitat (Figure 5).

4.3 Harbor Seal (*Phoca vitulina*)

4.3.1 Status

The harbor seal is protected under the MMPA but is not listed as a strategic or depleted species under the MMPA (Muto *et al.* 2017). The Harbor seal is not listed as threatened or endangered under the ESA.

The total statewide abundance estimate is 205,090 seals based on surveys taken between 1998 and 2011 (Muto *et al.* 2017). In the northeast Pacific, twelve stocks of harbor seals have been identified by NMFS, ranging from Baja California to the Aleutians and north to Cape Newman and the Pribilof Islands (Allen and Angliss 2014). Within Alaska there are a total of 12 stocks of harbor seals ranging along the coastal waters from the eastern coast of the Aleutian Islands to Cape Muzon in Southeast Alaska.

The Lynn Canal/Stephens Passage stock is found in the project area waters. The current population estimate for the Lynn Canal/Stephens Passage stock is 9,478 individuals, and the five-year trend estimate is -176. The probability of decrease of this stock is 0.71, indicating that evidence suggests that the stock is declining, however 9 of the 11 Alaska harbor seal stocks are showing a trend of increasing populations (Muto *et al.* 2017).

Only the Lynn Canal/Stephens Passage stock is considered in this application as it is the only stock present within the project area.

4.3.2 Distribution

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

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

Harbor seals use a variety of terrestrial sites to haul out for resting (year-round), pupping (May-July), and molting (August-September) including tidal and intertidal reefs, beaches, sand bars, and glacial/sea ice (Sease 1992; Klinkhart *et al.* 2008). Some sites have traditional/historic value for pupping and molting while others are used as temporary resting sites during seasonal foraging trips.

4.3.3 Statter Harbor Area

Harbor seals are common in the inside passages of southeastern Alaska. They are residents of the action area and can occur year-round, on any given day within the action area. See Section 6.3 for observations and estimates of harbor seals within the action area.

4.3.4 Reproduction and Breeding

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

4.3.5 Diving and Foraging

Harbor seals commonly dive to depths that are less than 20 meters but are capable of reaching depths of up to 1640 feet (500 meters). Harbor seals can remain submerged for over 20 minutes, although most dives are less than 4 minutes long (Klinkhart *et al.* 2008) with approximately 90% of dives being less than seven minutes (Gjertz *et al.* 2001; Eguchi and Harvey 2005). The maximum recorded dive time is 32 minutes (Eguchi and Harvey 2005)

Harbor seals commonly eat walleye pollock (*Theragra chalcogramma*), octopus (*Octopus spp.*), capelin (*Mallotus villosus*), herring (*Clupea pallasii*), and pacific cod (*Gadus macrocephalus*). Pups usually eat small fishes (Pitcher and Calkins 1979).

4.3.6 Hearing Ability

Outwardly, phocids like harbor seals lack pinna, the outer ear portion consisting of folds of skin that is common with many animals. The portion of the ear canal that is visible is "long, narrow, and filled with cerumen and hairs". This canal is closed by muscular attachments when seals are underwater (Kastak and Schusterman 1998).

The hearing range of harbor seals extends above 60 kHz (Jacobs and Terhune 2002) although their hearing is most acute below 60 kHz (Møhl 1968). Harbor seals are more sensitive to lower frequency sounds with the highest sensitivity occurring at 32 kHz in water and 12 kHz in air (Terhune 1988; Terhune and Turnbull 1995; Kastak and Schusterman 1998; Wolski *et al.* 2003).

Under laboratory conditions, Kastak (2008) induced temporary threshold shifts (TTS) of up to 30 dB in captive harbor seals exposed to white noise stimulus levels of 164 dB. Recovery from TTS took days if the threshold shifts exceeded 20 dB. He found that sound levels required to induce TTS were similar in air and underwater. An inverse relationship was found between exposure level and duration: higher levels of noise were required to induce TTS at lower durations (Kastak 2008).

In another captive study, harbor seals exposed to 200 Hz – 20 kHz sounds for 3-6 seconds were observed to respond by keeping their head above water or hauling out more often as the sound pressure level (SPL) was increased (Kastelein *et al.* 2017). At mean received behavioral threshold SPLs of 136-148 dB re 1 µPa, seals responded with "jump" behavior (Kastelein *et al.* 2017).

5 Type of Incidental Take Authorization Requested

Under Section 101(a)(5)(D) of the MMPA, CBJ D&H requests an IHA for takes by Level A harassment (i.e., non-serious injury or permanent [hearing] threshold shift) and Level B harassment (i.e., behavioral disturbance or temporary [hearing] threshold shift) (NMFS 2018b) during certain operations associated with the construction of the proposed project. CBJ D&H requests an IHA for one year with an effective date of October 1, 2018. If work included in Phase III A is not completed at the end of that period, CBJ D&H would request an IHA renewal.

Take is requested for the following activities;

- Dredging activities, in-water fill placement, and vibratory pile removal activities (as described in Section 1.3 and combined with the mitigation measures described in Section 11) have the potential to take permitted marine mammals by Level B harassment resulting in behavioral disturbance or temporary threshold shift (TTS) due to the effects of increased underwater noise levels.
- During vibratory pile removal and the drilling activities associated with blasting, the project has the potential to increase airborne noise levels for pinnipeds hauled out along the shoreline of Auke Bay. Airborne impact isopleths are substantially smaller than underwater impact isopleths for the same activities, so it is likely that any takes from airborne noise would already be accounted for in estimates for underwater noise impacts.
- Blasting (as described further in Appendix C and applying the mitigation measures described in Section 11) has the potential to take permitted marine mammals by Level B harassment resulting in TTS and to take Steller sea lions or harbor seals through Level A harassment resulting in permanent threshold shift (PTS) or non-serious injury.

The noise levels and potential impact isopleths that are expected to result from the construction of this project are described in detail in the sections below. Mitigation measures (including operational shutdown and monitoring zones) will be incorporated into the project to minimize the potential for unauthorized injury or harassment. Protocols for observations and mitigation methods are discussed in detail in Section 11 and in Appendix B. Takes of non-permitted species will be prevented by the mitigation measures described in Section 11.

5.1 Method of Incidental Taking

Statter Harbor Phase III A includes dredging, in-water fill placement, vibratory pile removal, drilling for blast shafts, and blasting in an area where Steller sea lions, humpback whales, and harbor seals are commonly observed. Planned construction methodologies will temporarily increase the underwater and airborne noise within the project area. This increase in noise has the potential to result in the behavioral disturbance, hearing threshold shifts, or non-serious injury of marine mammals in the vicinity of the construction project.

5.2 Regulatory Thresholds and Modeling for the Effects of Anthropogenic Sound

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

- Peak Sound Pressure Level (SPL_{PK}): The maximum absolute value of the instantaneous sound pressure that occurs during a specified time interval, measured in dB re: 1 μPa (e.g., 198 dB_{PEAK}). (Caltrans 2015)
- Average Root Mean Square Sound Pressure Level (SPL_{RMS}): A decibel measure of the square root of mean square pressure. For pulses, the average of the squared pressures over the time that comprises

that portion of the wave form containing 90 percent of the sound energy of the impulse in dB re: 1 μPa (for underwater) and in dB re: 20 μPa is used (e.g., 185 dB_{RMS}). (Caltrans 2015)

- Sound Exposure Level (SEL): The integral over time of the squared pressure of a transient waveform, in dB re: 1 μPa^2–sec. (e.g., 173 dB_{SEL}). This approximates sound energy in the pulse. (Caltrans 2015)
- Cumulative Sound Exposure Level (SEL_{CUM}): Cumulative exposure over the duration of the activity within a 24-hour period. (NMFS 2018)

5.2.1 Updated Cumulative Sound Threshold Guidance, PTS

Determination of the cumulative underwater sound exposure levels (SEL_{CUM}) required to cause PTS in marine mammals within the project area was based on the technical guidelines published by NMFS on August 03, 2016 and revised in April, 2018. This guidance considers the duration of the activity, the sound exposure level produced by the source during one working day, and the effective hearing range of the receiving species. Regulatory thresholds for potentially affected species, measured in one-day SEL_{CUM}, are summarized below.

Table 3. SEL_{CUM} PTS Onset Thresholds. (NMFS 2018)

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

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

5.2.2 Updated Peak Sound Threshold Guidance, TTS and PTS

In addition to thresholds for cumulative noise exposure, onset thresholds for peak sound pressures must be considered for impulsive sources. Peak sound pressure level (SPL_{PK}) is defined as "the greatest absolute instantaneous sound pressure within a specified time interval and frequency band" (NMFS 2018).

Table 4. SPL_{PK} Thresholds for Impulsive Noise. (NMFS 2018)

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

Blasting is the only activity with peak levels above peak. Calculated SPL_{PK} impact isopleths for blasting are included in Section 5.4, and the calculation methodology is described in Appendix D.

5.2.3 Interim Sound Threshold Guidance, Behavioral Disturbance

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

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

Behavioral disturbance modeling is not applicable to individual underwater blasts because of the nearly instantaneous nature of the explosive noises. This was confirmed during the August 14, 2017 meeting with USACE and NMFS as well as the September 5, 2017 teleconference with NMFS headquarters.

Table 5. Behavioral Disturbance Thresholds. (NMFS 2015)

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

Per the interim guidance, the practical spreading loss model was used to determine the zones in which pinnipeds and cetaceans have the potential to face behavioral disturbance from underwater noise.

The formula for calculating practical spreading loss in *underwater noise* is:

$$TL = GL \times \log \frac{R_1}{R_0}$$

where TL is the transmission loss (dB), GL is the geometric loss coefficient (15 is the only valued allowed without real-time sound source verification), R_1 is the range to the target sound pressure level (m), and R_0 is the distance from the source of the initial measurement (m).

Per the interim guidance, the spherical spreading loss model was used to determine the zones in which pinnipeds and cetaceans have the potential to face behavioral disturbance from airborne noise.

The formula for calculating spherical spreading loss in *airborne noise* is:

$$TL = GL \times \log \frac{R_1}{R_0}$$

where TL is the transmission loss (dB), GL is the geometric loss coefficient (20 is the standard value), R_1 is the range to the target sound pressure level (m), and R_0 is the distance from the source of the initial measurement in meters.

5.2.4 Blasting Injury and Mortality Threshold Guidance

A meeting was held between CBJ, USACE, and NMFS on August 14, 2017 to discuss threshold calculation for underwater blasting. During this meeting the General Blast Plan (Appendix D) was reviewed. Discussion revealed that only SPL thresholds were initially used to determine potential impact zones and that the SEL metric also needed to be utilized. A second teleconference with PND, Alaska Seismic and Environmental (ASE) and NMFS (Jaclyn Daly and Shane Guan) was held on September 5, 2017 regarding how to calculate PTS and TTS thresholds for blasting using the SEL metric. Following these meetings, ASE prepared an SPL and SEL Isopleth Distances Report detailing the dual metric analysis and how the potential impact zones for each hearing group were determined. On April 2, 2018, additional metrics for potential mortality and non-auditory physical injury were provided by NMFS and added to the modeling for blasting zones. During this process, the earlier blasting TTS and PTS zones were revised to reflect differences in SEL cumulative and acoustic impulse thresholds and revise calculation methodologies. In July 2018, an updated User Spreadsheet Tool was provided by NMFS that included a model for calculation of TTS and PTS disturbance isopleths for explosives.

Official sound threshold guidance has not been published by NMFS for the potential exposure of marine mammals to sound from explosive impulses with the capacity to cause mortality, slight lung injury, or mortality. The minimum acoustic impulses for predicting the onset of mortality and slight lung injury and the peak sound pressures capable of causing GI tract proposed in Finneran and Jenkins (2012) will be used as thresholds for this project.

The minimum acoustic impulse for predicting the onset of mortality (I_M) is defined in Finneran and Jenkins (2012) as:

$$I_M(M,D) = 91.4M^{1/3}\left(1+\frac{D}{10.1}\right)^{1/2}$$

where M is the animal mass (kg), D is the animal depth (m), and the units of IM are Pa·s.

The minimum acoustic impulse for predicting the onset of slight lung injury (I_S) is defined in Finneran and Jenkins (2012) as:

$$I_S(M,D) = 39.1M^{1/3}\left(1+\frac{D}{10.1}\right)^{1/2}$$

Acoustic impulse thresholds were calculated based on the body masses of newborn calves or pups by species (provided in the same study) and on an assumed receiving animal depth of 10 meters (selected as a more conservative value than the maximum project area depth of approximately 50 meters). A threshold for non-serious injury to the GI tract of unweighted SPL_{PK} of 237 dB re 1 μPa was used for all marine mammals exposed to underwater explosions. (Finneran and Jenkins, 2012)

Table 6. Calculated thresholds for blasting injury. (Finneran and Jenkins 2012)

	Low Frequency Cetaceans (LF)	Mid-Frequency Cetaceans (MF)	High Frequency Cetaceans (HF)		Phocid Pinnipeds (PW)		Otariid Pinnipeds (OW)	
	Humpback Whale	Killer Whale	Harbor Porpoise	Dall's porpoise	Harbor Seal	Northern Fur Seal	Steller Sea Lion	California Sea Lion
Mortality (Pa s)	1133.8	700.0	220.5	234.3	246.7	204.7	324.9	234.3

	Low Frequency Cetaceans (LF)	Mid-Frequency Cetaceans (MF)	High Frequency Cetaceans (HF)		Phocid Pinnipeds (PW)		Otariid Pinnipeds (OW)	
	Humpback Whale	**Killer Whale**	**Harbor Porpoise**	**Dall's porpoise**	**Harbor Seal**	**Northern Fur Seal**	**Steller Sea Lion**	**California Sea Lion**
Slight Lung Injury (Pa s)	485.0	299.4	94.3	100.2	105.5	87.6	139.0	100.2
GI Tract Injury (SPL_{PK})	237 dB re 1 μPa							

5.3 Sources of Anthropogenic Sound

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

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

5.3.1 Underwater Sources

The closest known measurements of vibratory pile removal similar to this project are from the Kake Ferry Terminal project for vibratory extraction of an 18-inch steel pile. The extraction of 18-inch steel pipe piles using a vibratory hammer resulted in underwater noise levels reaching 156.2 dB_{RMS} at 7 meters (Denes *et al.* 2016). The pile diameters for the proposed project are smaller, thus the use of noise levels associated with the pile extraction at Kake are conservative.

For dredging and dredge disposal, sound source data was used from bucket dredging operations in Cook Inlet, Alaska (Dickerson *et al.* 2001). Dredging in that project consisted of six (6) distinct events, including the bucket striking the channel bottom, bucket digging, winch in/out as the bucket is lowered/raised, dumping of the material on the barge and emptying the barge at the disposal site. Although the waveform of the bucket strike has a high peak sound pressure with rapid rise time and rapid decay, the duration was potentially 1-3 seconds, and following events where of even longer duration and were non-impulsive in form. Therefore, 104 SPL_{RMS} measurements for the first five distinct phases of the dredging cycle were averaged and distance corrected to determine an average SPL_{RMS} of 150.5 dB_{RMS} at 1 meter for the bucket dredging process, with an assumed maximum duration of up to 50 seconds of non-impulsive, intermittent noise.

In-water fill placement and removal activities (including the placement and removal of the basting pad and the placement of the MSE wall and armored slopes) are assumed to have similar noise levels to dredging activities because they operate similar (or identical) equipment performing similar (or identical) activities.

For dredge material disposal, noise calculations were based on the measured maximum level of 108.7 dB_{RMS} at 316 meters recorded in Cook Inlet for emptying the material from the barge (Dickerson *et al.* 2001).

The placement of in-water fill essentially creates a dry area for the contractor to drill the holes for blasting when the tide is below +15 feet (4.6 meters) MLLW, so no underwater noise is anticipated from drilling.

Source levels for activities with the potential to create significant underwater noise as well as parameters used in the calculation of isopleths are summarized in Table 7.

Table 7. Parameters for underwater noise calculations

Source	Source Type	SPL_{RMS}	Weighting Factor Adjustment	Estimated Duration	
				Hours per Day	Ant. Days of Effort
Vibratory Removal Steel	Non-impulsive, continuous	156.2 dB_{RMS}[b] at 23 ft (7 m)	2.5 kHz	2	1 - 5
Vibratory Removal Timber	Non-impulsive, continuous	152.4 dB_{RMS}[b] at 56 ft (17 m)	2.5 kHz	8	2 - 5
Dredging	Non-impulsive, intermittent	150.5 dB_{RMS}[a] at 3 ft (1 m)	2.5 kHz	11	30-45
In-Water Fill Placement and Removal	Non-impulsive, intermittent	150.5 dB_{RMS}[a] at 3 ft (1 m)	2.5 kHz	11	15
Dredge Disposal	Non-impulsive, continuous	108.7 dB_{RMS}[a] at 1,037 ft (316 m)	2.5 kHz	0.25	30-45

([a]Dickerson et al. 2001, [b]Denes 2016)

Vibratory pile removal can most likely be completed within a day or two, but a conservative estimate of five days is provided in the Table 7. Estimated cycling of pile removal noise is conservatively 20 minutes out of every 30 to remove one pile, for a total duration of 2 hours of steel pile removal and 16 hours (over two days) of timber pile removal. Dredging and in-water fill placement are similarly estimated at a conservative 11 hours per day, allowing for the necessity for safety meetings, equipment inspections, and other breaks in work. Dredge disposal from the dump barge is anticipated at 15 minutes or less per day.

Anticipated noise levels from the blasting for excavation of the harbor basin are discussed more fully in Appendix D. Historic data from an analog project were analyzed to create a conservative attenuation model for anticipated pressure levels from confined blasting in drilled shafts in underwater bedrock. Sound pressure data from the analog project was analyzed to compare source pressure levels to received impulse levels. These models were used to predict distances to the peak level and impulse thresholds summarized in Section 5.2.4. Cumulative source levels from the analog project were used in conjunction with the NMFS 2018 updated User Spreadsheet Tool for predicting threshold shift isopleths for multiple detonations, after being corrected to a 1-meter reference source using the practical spreading loss model.

Table 8. Parameters for blasting cumulative impacts calculations

Source	SEL_{CUM} (dB re: 1 μPa^2)	SPL_{PK} (dB re: 1 μPa)	Weighting Factor Adjustment	Estimated Duration	
				Seconds per Day	Num. of detonations in 24 hours
Blasting	228.4 dB at 3 ft (1 m)	245.9 dB at 3 ft (1 m)	1 kHz	0.5	75

5.3.2 Airborne Sources

Data for vibratory driving of 30-inch piles from Laughlin (2010) was measured at 96.4 dB_{L5EQ} at 15 meters. In this case, dB_{L5EQ} (or the 5-minute average continuous sound level) was considered equivalent to dB_{RMS} values, which would be calculated in a similar fashion. Vibratory removal of 18-inch piles is assumed to create lower noise levels than installation of 30-inch piles, so this value was used for pile removal. Similarly, this value was used as a conservative analog for the drilling of holes for blasting. Holes drilled for blasting will be significantly smaller, at between 3.5 and 4.5 inches.

5.4 Calculated Impact Isopleths

Table 9. Calculated Isopleths – Underwater Sources

Source	PTS Onset Isopleth					Behavioral Disturbance Isopleth
	Low Frequency Cetaceans (LF)	Mid-Frequency Cetaceans (MF)	High Frequency Cetaceans (HF)	Phocid Pinnipeds (PW)	Otariid Pinnipeds (OW)	Cetaceans & Pinnipeds
Vibratory Pile Removal (Steel)	9.1 ft (2.8 m)	0.8 ft (0.2 m)	13.4 ft (4.1 m)	5.5 ft (1.7 m)	0.4 ft (0.1 m)	5950 ft (1813 m)
Vibratory Pile Removal (Timber)	31.1 ft (9.5 m)	2.8 ft (0.8 m)	45.9 ft (14.0 m)	18.9 ft (5.8 m)	1.3 ft (0.4 m)	8060 ft (2457 m)
Dredging and In-Water Fill Placement and Removal	1.8 ft. (0.5 m)	0.2 ft (0.0 m)	2.6 ft. (0.8 m)	1.1 ft. (0.3 m)	0.1 ft. (0.0 m)	355 ft (108 m)
Dredge Disposal	0.2 ft (0.0 m)	0.0 ft (0.0 m)	0.2 ft. (0.1 m)	0.1 ft (0.0 m)	0.0 ft (0.0 m)	Source level below threshold

Table 10. Calculated Isopleths – Airborne Sources

Source	Source Level	Behavioral Disturbance Isopleth	
		Harbor Seals	Other Pinnipeds
Vibratory Removal – Steel Pile	96.4 dB_{L5EQ} at 15 meters[a]	105 ft (31.8 m)	33.0 ft (10.1 m)

Source	Source Level	Behavioral Disturbance Isopleth	
		Harbor Seals	Other Pinnipeds
(Analog for drilling blast shafts)	96.4 dB_{L5EQ} at 15 meters[a]	105 ft (31.8 m)	33.0 ft (10.1 m)

([a]Laughlin 2010)

Table 11. Calculated TTS Isopleths – Blasting

TTS Onset Isopleths					
	Low Frequency Cetaceans (LF)	**Mid-Frequency Cetaceans (MF)**	**High Frequency Cetaceans (HF)**	**Phocid Pinnipeds (PW)**	**Otariid Pinnipeds (OW)**
SPL_{PK} Threshold (dB re 1µPa)	213	224	196	212	226
SPL_{PK} Isopleth	537.1 ft (163.7 m)	158.9 ft (48.4 m)	3527.0 ft (1075.0 m)	600.0 ft (182.9 m)	127.4 ft (38.8 m)
SEL_{CUM} Threshold (dB re 1µPa² s)	168	170	140	170	188
SEL_{CUM} Isopleth	1652.6 ft (503.7 m)	14.1 ft (4.3 m)	385.6 ft (117.5 m)	496.6 ft (151.4 m)	36.7 ft (11.2 m)

Table 12. Calculated PTS Isopleths – Blasting

PTS Onset Isopleths					
	Low Frequency Cetaceans (LF)	**Mid-Frequency Cetaceans (MF)**	**High Frequency Cetaceans (HF)**	**Phocid Pinnipeds (PW)**	**Otariid Pinnipeds (OW)**
SPL_{PK} Threshold (dB re 1µPa)	219	230	202	218	232
SPL_{PK} Isopleth	276.5 ft (84.3 m)	81.8 ft (24.9 m)	1815.3 ft (553.3 m)	308.8 ft (94.1 m)	65.6 ft (20.0 m)
SEL_{CUM} Threshold (dB re 1µPa² s)	183	185	155	185	203
SEL_{CUM} Isopleth	165.3 ft (50.4 m)	1.4 ft (0.4 m)	38.6 ft (11.8 m)	49.7 ft (15.1 m)	3.7 ft (1.1 m)

Table 13. Calculated Mortality and Injury Isopleths – Blasting

	Low Frequency Cetaceans (LF)	Mid-Frequency Cetaceans (MF)	High Frequency Cetaceans (HF)		Phocid Pinnipeds (PW)		Otariid Pinnipeds (OW)	
	Humpback Whale	**Killer Whale**	**Harbor Porpoise**	**Dall's porpoise**	**Harbor Seal**	**Northern Fur Seal**	**Steller Sea Lion**	**California Sea Lion**
Mortality	52.6 ft (16.0 m)	76.6 ft (23.4 m)	157.7 ft (48.1 m)	153.0 ft (46.6 m)	149.0 ft (45.4 m)	163.5 ft (49.8 m)	127.9 ft (39.0 m)	153.0 ft (46.6 m)
Slight Lung Injury	99.4 ft (30.3 m)	134.1 ft (40.9 m)	220.6 ft (67.2 m)	216.5 ft (66.0 m)	213.0 ft (64.9 m)	225.4 ft (68.7 m)	193.2 ft (58.9 m)	216.5 ft (66.0 m)
GI Tract Injury	37.7 ft (11.5 m)							

6 Number of Marine Mammals that May Be Affected

We are requesting the issuance of an IHA from October 1, 2018 through May 31, 2019 for take of MMPA-defined stocks that include animals in the endangered Steller sea lions wDPS and humpback whales from the threatened Mexico DPS. This IHA request covers these ESA-listed species in their respective MMPA-defined stocks and covers anticipated takes of non-ESA listed populations and harbor seals.

The number of marine mammals that may be exposed to noise is calculated by estimating the likelihood of a marine mammal being present within calculated impact isopleths during the associated activities. Expected marine mammal presence is determined by past observations and general abundance near the proposed project area during construction.

Based upon the actions described above, their anticipated effect on marine mammals, and number of animals in the project area, we anticipate that a number of animals will be taken by the proposed actions. CBJ D&H is pursuing an IHA for these potential takes. The estimated number of takes are based upon conservative ranges from the best scientific data currently available for these species near the project area. We *do not* anticipate this many takes will occur, as our avoidance and minimization of impacts efforts on the grounds during the construction activity will be informed, deliberate, focused and integrated throughout all levels of project management and monitoring.

6.1 Humpback Whale

Humpback whales occur frequently in Auke Bay in winter on an intermittent basis, but their genetic and stock-designation identities are rarely known: individuals are indistinguishable unless humpback whale fluke or dorsal fin shape and pattern are known. Data on their distribution suggests that both the mDPS and Hawaii DPS of humpback whales may be present in Auke Bay. No quantitative agency data or published reports on marine mammals in Auke Bay are available at the time of this writing.

For information on marine mammal in the Auke Bay Statter Harbor project area, several long-standing researchers, naturalists and academic scientists were consulted regarding the presence and abundance of these species in Auke Bay, and their typical winter habitat use patterns in the broader Auke Bay region and Statter Harbor, specifically. Individuals consulted provided records consisting of written survey counts, recorded opportunistic observations, or date-linked imagery such as photographs and video clips from which positive species identifications and individual counts could be made. These data were compiled by Oceanus Alaska (Ridgway unpubl. data 2017).

Some whale researchers, resource managers, and whale watching guides track the presence of individual Humpback whales in the Juneau area by unique fluke patterns (Krieger *et al.* 1986, Teerlink 2017). Based on fluke pattern identification, Krieger, Baker and Wing identified 189 unique whales in the Juneau to Glacier Bay and Seymour Canal area (Krieger *et al.* 1986). In recent years, 179 individual humpback whales were identified from the Juneau area, based upon fluke photographs taken between 2006 and 2014 (Teerlink 2017).

For the waters closer to the Auke Bay project vicinity, including Stephens Passage, Saginaw Channel, Favorite Channel, and Lynn Canal, researchers have documented 4 to 18 humpback whales in winter (Krieger and Wing 1986, Moran *et al.* 2017). Residents immediately north of Tee Harbor (Quinn unpubl. data 2017) have maintained records of opportunistic whale observations since 1994. Winter records for months October through May were extracted from these data for analysis. During the 24-year observation period, a total of 483 observations were recorded of 709 individual humpback whales (Quinn unpubl. Data 2017). Of these, 483 sightings were of single whales, 96 observations were of two whales (pairs or two individuals), and 40 observations were of groups ranging from 3 to 12 individuals each. Many presumed mother-calf pairs were noted. Whales in this area engaged in a wide range of activities, including feeding, browsing, trumpeting, vocalizing (a wide range of tones and rhythms), sleeping and transiting. This observation area is within 10 nm (~16 km) of the project area, and whales seen here are presumed to move in and out of Auke Bay throughout the winter months.

For the years 2013 through 2017, 117 observational records of humpback whales were taken during oceanographic surveys in Auke Bay from Statter Harbor breakwater, ABMS dock, and by boat on a monthly or quarterly basis (Ridgway unpubl. data 2017). Additional records were taken from opportunistic surveys from the Auke Bay Marine Station observation pier on a more frequent basis during winter months. Typical numbers observed at any given time are 0-1 whales. Four whales in a single day have been seen every year in at least three winter months, and in one year up to seven individuals have been observed inside Auke Bay concurrently during at least one month. Carlson and Haight reported observing one to nine whales in Auke Bay from 1973-1984.

These data were compiled with University of Alaska Southeast student survey data from 2015-2016 (Pearson *et al.* unpubl. data 2017) and additional observation records from multiple sources to build a non-continuous time series of marine mammal occurrence in Auke Bay. Photographs, video, and media reports on mammal occurrences were used to augment written records. Thirteen individuals and agencies contributed data records or time-linked countable imagery. Images of individual animals were used to document presence/absence of a species in Auke Bay, and specific habitat was noted if recognized. Photographs and images of multiple animals were reviewed and individually counted twice by independent viewers, and the lower confirmed count was entered.

In the winter of 2015 and 2016, two whales slept in the harbor at night over a five-week period between the headwalk float and the shore, often against a large wooden tugboat that winters in the harbor. Other whales have been observed sleeping in 2016 and 2017 alongshore near the Auke Bay ferry terminal.

In addition to count data, the local whale fluke database was used for matching individual whale identifications; Teerlink (2017) and others have observed two individual whales in Auke Bay on multiple occasions in 2017:

Figure 6. Humpback whale "Dot Spot"

Humpback whale no. 1443, named "Dot Spot" was in Auke Bay Harbor on February 18, 2017; March 05, 2017; and March 13, 2017. Other observers have confirmed that Dot Spot was likely the most frequently observed whale in Auke Bay Statter Harbor from 2015 to 2017 (Armstrong pers. comm. 2017, Bakker pers. comm. 2017; S. Teerlink 2017).

Humpback whale no. 2460 (no name). Teerlink observed no. 2460, multiple times across three winter seasons in Auke Bay: October 1 to May 31 2015, 2016 and 2017.

Figure 7. Humpback whale No. 2460

Neither whale no. 1443 nor 2460 have been linked to breeding ground identifications, hence, the DPS from which they originate is not currently known.

Humpback whales utilize habitats in the project area intermittently. The breakwater and other dock structures appear to serve as fish-attracting devices (FADs), where forage fish (herring, capelin, sandlance, pollock, and juvenile salmon) aggregate and are targeted by diving humpback whales. Two humpback whales in recent years have also targeted a shallow trough off the east end of the Statter harbor breakwater for deeper diving foraging excursions targeting herring and possibly juvenile pollock (Ridgway pers. observ.). Some individual whales enter Auke Bay through the north Coghlan Island entrance and conduct a pattern of exploitation or "browsing" in the bay and inner harbor. In this area some whales lunge feed and gulp massive volumes of feed in seawater immediately adjacent to or rubbing against boats, docks and other structures in deep to shallow waters throughout the action area. These whales have been observed continuing a pattern search alongshore to Auke

Creek and up Fritz Cove, where they have been seen lunge feeding in small coves and gullies in shallow water to aggregate schooling fish.

Because humpback whale individuals of different DPS (natal) origin are indistinguishable from one another (unless fluke patterns are linked to the individual in both feeding and breeding ground), the frequency of occurrence of animals by DPS is only *estimated* using the DPS ratio, based upon the assumption that the ratio is consistent throughout the Southeast Alaska region (Wade *et al.* 2016).

We believe that the proposed action will likely result in direct and indirect impacts on humpback whales through short-term harassment, possible alteration of transit or sleeping locations, and temporary prey species displacement. For purposes of estimating effects and takes of the mDPS of humpback whales, we acknowledge that they cannot be readily distinguished from non-listed humpback whales in the project area and assume that some whales are from the mDPS. Similarly, all whales in the project area are protected under the MMPA, and this will be reflected in the IHA documentation.

Using a likely daily potential maximum rate of two humpback whales per day, the project could take up to two humpback whales by Level B Harassment each day of pile removal activities and blasting. No takes by Level B harassment are requested for dredging, dredge disposal, or in-water fill placement or removal as the impact areas for these activities are smaller than the minimum 10-meter shutdown zone that will be observed for all in-water activities. No takes for Level A harassment are requested for humpback whales, as they are unlikely to be found within the shallow restricted area within range of Level A harassment.

The Level B harassment potential from the proposed activities is **not likely** to result in significant adverse impacts to any humpback whales.

Table 14. Estimated number of takes of humpback whales[1]

Number of Estimated Takes per Construction Activity						
Species	**Pile Removal**	**Dredging**	**Dredge Disposal**	**In-Water Fill Placement/Removal**	**Blast Level B**	**Blast Level A**
	(10 days)	**(45 days)**	**(45 days)**	**(15 days)**	**(2 days)**	**(2 days)**
Humpback Whale Hawaii DPS	18.8	No takes requested	No takes requested	No takes requested	3.8	No takes requested
Humpback Whale Mexico DPS	1.2				0.2	
Total Takes	24 (Level B)					

1 Estimated number of total takes of mDPS humpback whales incidental to each activity with the potential to result in take. Basis for total take of humpback whales in Statter Harbor: likely daily counts of two or one humpback whales in Statter Harbor (of which 6.1% may be of the mDPS) X #days of activity.

6.2 Steller Sea Lion

Steller sea lions occur in Auke Bay in winter on an intermittent basis, but their genetic and stock-designation identities are rarely known: individuals are indistinguishable unless sea lions are branded (and the brand is observed). Satellite-tagged individual animals from the Benjamin Island haulout and Auke Bay were observed multiple times between November 2010 and January 2011 (Fadely 2011), and the Auke Bay boating community frequently observes Steller sea lions moving to and from the haulout complex into Auke Bay. No quantitative agency data or published reports on marine mammals in Auke Bay are available at the time of this writing.

From 2013-2017, Steller sea lion have been documented in Auke Bay travelling as individuals or in herds of 50 to an estimated 120+ animals, during every month of the winter season. During winter 2015-2016, Steller sea lions foraged aggressively on young herring and 1-2-year-old Walleye pollock for over 20 days, continuously. Some sea lions were also observed consuming small flatfish, likely yellowfin sole, harvested from the seafloor (depth 25-45 meters), during this period. While no sea lions were observed hauled out on beaches or structures in the harbor, large rafts of 20-50 animals formed and rested in the outer harbor area between foraging bouts. Simultaneous surface counts of 121 individual sea lions suggests that likely upwards of 200 animals or more were targeting prey in Statter Harbor during herring aggregation events. These 121 to 200 animals comprise roughly 20 to 30% of the animals typically found at the Benjamin Island and Little Island haulout complexes during winter months. (Ridgway pers. observ.)

Figure 8. Steller sea lions aggressively foraging on Auke Bay herring. December 2015. Photo: Jos Bakker

Since 1988, ADF&G has branded a sample of Steller sea lion pups born on Southeast Alaska rookeries as a means of studying the life history and movements of this population. Temporal and regional re-sights of branded SSLs have helped document a degree of mixing of eDPS and wDPS Steller sea lions in Southeast Alaska waters (Jemison *et al.* 2013).

Only three individual, branded wDPS Steller sea lions have been observed at Benjamin Island, the closest haulout, from 2003-2006 with a maximum of 3 sightings per individual. No branded wDPS individuals have been observed in the ADF&G surveys from 2007-2016. The 2007 ADF&G surveys offer the most abundant data for Steller sea lion counts at Benjamin Island. A total of 11 surveys were conducted between January and July 2017, ranging from 0-768 Steller sea lions, with an average count of 404 individuals. In 2007 no wDPS animals were observed. While it is possible an individual from the wDPS may be at the Benjamin Island haulout, it is rare, and none have been documented at this haulout for the last decade (Austin pers. comm. 2018).

Although recent data in the northern part of the eastern DPS indicate movement of western sea lions east of the 144° line, the mixed part of the range remains small (Jemison *et al.* 2013) and the overall discreteness of the eDPS from the wDPS remains distinct. Based on observations by ADF&G over the last decade this project is unlikely to impact wDPS individuals. The recent IHA application for the Haines Ferry Terminal indicates a conservative estimate of 1.6% eDPS individuals may occur at the Gran Point haulout (shown in Figure 5). To be conservative it is assumed that 2% of the Steller sea lions at Benjamin Island may be from the wDPS.

Using a potential daily maximum rate, the project could take up to 121 Steller sea lions each day of pile removal activities (50% for dredging and fill placement/removal due to lower probability of occurrence in the smaller monitoring zone). It will be (conservatively) assumed that no more than 120 individual sea lions will enter the outer harbor each day and no more than 20 are likely to be found within the inner harbor, and these numbers will be used for blasting calculations. No takes by Level B harassment are requested for dredge disposal, as the impact areas is smaller than the minimum 10-meter shutdown zone that will be observed for all in-water activities. The maximum daily count of 121 was used to make this determination as Steller sea lions have been observed in large herds within the harbor in excess of seven days when prey is abundant. Thus, during these times it is likely that the rate of taking would be significantly higher as the animals will be counted more than once if they dive and/or leave and re-enter the monitoring zone. On other days when dense groups are not present, significantly fewer takes will be encountered, and it is assumed the overall take levels will even out.

Table 15. Estimated number of takes of Steller sea lions

Number of Estimated Takes per Construction Activity						
Species	**Pile Removal**	**Dredging**	**Dredge Disposal**	**In-Water Fill Placement/Removal**	**Blast Level B**	**Blast[1] Level A**
	(10 days)	**(45 days)**	**(45 days)**	**(15 days)**	**(2 days)**	**(2 days)**
Steller Sea Lion eDPS	1,185.8	2,668.1	No takes requested	889.4	118.6	39.2
Steller Sea Lion wDPS	24.2	54.5		18.2	2.4	0.8
Total Takes	4,961 (Level B) 40 (Level A)					

Due to the feeding behavior of sea lions within Auke Bay, there is a chance the injury zones will not be clear at the time of the blast. The explosives cannot "sleep" for longer than 24 hours without becoming a risk to private property and human health, and they cannot be detonated in the dark. Charges will not be emplaced if marine mammals are present within the injury zone or if a protected species seems likely to enter the injury zone; however, it is possible that they may arrive after emplacement has begun. If Steller sea lions enter the blast injury area following the commencement of emplacement, detonation will be delayed as long as possible. All other legal measures to avoid injury will be utilized; however, the blast will be detonated when delay is no longer feasible. This activity has the potential for takes by Level A Harassment with possible effects including PTS and slight injury. Due to the confined nature of the blast, it is not anticipated that severe injury or mortality are likely results of the proposed activity.

The Level B harassment and limited Level A harassment potential from the proposed activities is **not likely** to result in significant adverse impacts to Steller sea lions.

6.3 Harbor Seal

Harbor seals are residents of the project area and observed within the harbor on an extremely regular basis and can be found within the immediate project vicinity on a daily basis. Over the last three winters, a group of up to 12 harbor seals has been observed in inner Statter Harbor near the harbormaster building along with 1-2 dispersed seals near the Auke Creek shoreline (Kate Wynne pers. observ.). Additionally, other counts from 2014-2016 recorded 2-16 animals within Statter Harbor. Because harbor seals are nearly always present in the harbor,

[1] Estimated number of Level A takes for blasting is estimated based on the number of sea lions likely to be present in the inner harbor area (~20).

the determination of estimated takes is on the conservative side; animals are likely to be recorded more than once each day as it likely not possible to determine if they are the same individuals. Up to 52 individual seals have been photographed simultaneously hauled out on the nearby dock at Fishermen's Bend (Ridgway unpubl. data). Direct effects of construction noise in this area will be partially blocked by the recently constructed Phase II boat launch and parking area. We assume that the majority of animals that haul out on the nearby floats at Fishermen's Bend are likely to go under water and resurface throughout the duration of the project. Sightings can be estimated on the assumption seals dive and resurface every 15 minutes, with an exposure of 16 harbor seals every 15 minutes during 12-hour work days.

Using a potential daily maximum rate, observers could sight up to 768 harbor seals each day of the project**.** A rate of take of no more than 52 individual seals per day will be used for the project (50% for dredging and fill placement/removal due to lower probability of occurrence in the smaller monitoring zone). This rate caps take at an assumed rate, though sighting rates will include multiple counts of the same individuals. It is assumed that no more than 52 individual seals will enter the outer harbor each day and that no more than 11 are likely to be found within the inner harbor, which will be used for Level A blasting calculations. As it is anticipated that many more sightings and re-sightings may be recorded by observers, the project proponents will continue to consult closely with NMFS regarding number of takes incurred throughout the project.

Due to the number of harbor seals commonly within the blast area, there is a chance the injury zones will not be free of seals at the time of the blast. The explosives cannot "sleep" for longer than 24 hours without becoming a risk to private property and human health, and they cannot be detonated in the dark. Charges will not be emplaced if marine mammals are present within the injury zone or if a protected species seems likely to enter the injury zone; however, it is possible that they may arrive after emplacement has begun. If harbor seals enter the blast injury area following the commencement of emplacement, detonation will be delayed as long as possible. All other legal measures to avoid injury will be utilized; however, the blast will be detonated when delay is no longer feasible. This activity has the potential for takes by Level A harassment with possible effects including PTS and slight injury. Due to the confined nature of the blast, it is not anticipated that severe injury or mortality are likely results of the proposed activity.

The Level B harassment and limited Level A harassment potential from the proposed activities is **not likely** to result in significant adverse impacts to harbor seals.

Table 16. Estimated number of takes of harbor seals

Number of Estimated Takes per Construction Activity						
Species	**Pile Removal**	**Dredging**	**Dredge Disposal**	**In-Water Fill Placement/Removal**	**Blast Level B**	**Blast Level A**
	(10 days)	**(45 days)**	**(45 days)**	**(15 days)**	**(2 days)**	**(2 days)**
Harbor Seals	520	1,170	No takes requested	390	104	22
Total Takes	2,184 (Level B) 22 (Level A)					

7 Anticipated Impact on Species or Stocks

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

Likely effects may include temporary behavioral responses to non-injurious noise from in-water construction activities and minor alteration in transit route due to barge and dredge disposal operations in central Auke Bay. However, Statter Harbor is the busiest harbor in Juneau and, due to the proximity of the disposal site to the harbor, the barge is likely to have a negligible effect on overall vessel traffic and animal transit routes. Physical elements of critical habitat will not be affected by the proposed action. Underwater sounds will likely disaggregate schools of forage fish in the action area and dredge deposition area. ESA-listed species may experience some energetic cost from short term dispersal of prey, resulting in short term expenditure of energy seeking other sources or waiting for prey to re-aggregate following noise effects.

7.1 Noise

Pinnipeds and cetaceans are sensitive to underwater and airborne noise. Recent studies have shown that even moderate levels of underwater noise can cause a temporary loss in hearing sensitivity in some marine mammals (Kastak *et al.* 2005). Increases in noise levels from in-water activities can reduce a marine mammal's capability to hear other noises, like background noise and noise created by their prey and predators, otherwise known as auditory masking (Southall *et al.* 2007). This results in difficulties with communication, predator avoidance, and prey capture, among others. Anthropogenic sounds can also result in behavioral modification, including changes in foraging and habitat use or separation of mother and infant pairs (MMC 2007).

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

The proposed project will have the possibility of resulting in Level B harassment of pinnipeds and cetaceans. Level B harassment is temporary in nature, and the impacts associated with the potential harassment resulting from this project will be temporary. Mitigation measures discussed in Section 11, such as soft start procedures, will be incorporated into the project to minimize the potential for Level A harassment. Level A harassment may result from the two isolated blasts; however, every effort will be made to time these activities so as to minimize impacts.

7.2 Vessel Interactions

Auke Bay is a sheltered bay located to the east of the intersection of Stephens Passage, Favorite Channel, and Saginaw Channel. The Auke Bay Ferry Terminal, part of the Alaska Marine Highway System, is located to the west of the project site within Auke Bay. The Auke Bay Loading Facility is located adjacent to the ferry terminal. This, in conjunction with Statter Harbor and Fishermen's Bend, results in Auke Bay being a major traffic area for commercial and recreational vessels.

Close proximity to vessel presence has been observed to disrupt feeding aggregations of humpbacks, including separation of mothers and calves, as well as disperse the fish schools they were targeting (Krieger and Wing

1986). In addition to its acoustic impacts, vessel traffic also poses a direct threat to humpbacks through ship-strike injury and mortality (Muto *et al.* 2017). Vulnerability to ship-strike may be higher in areas where humpbacks rest, as they spend three times as much time at the surface when resting than when traveling fast. However, Statter Harbor is the busiest harbor in Juneau with frequent commercial and recreational boat traffic in and out of the harbor and no known vessel strikes have occurred in the harbor.

The proposed project has the potential to increase temporarily the number of vessels using Auke Bay. Because the adjacent moorage facilities are utilized less in the winter there will be decreased vessel traffic during the construction window. The harbor is currently overcrowded and thus the new commercial floats will ease congestion rather than create a significant permanent increase in vessel traffic, since the commercial charter vessels currently utilize the crowded harbor. The new permanent moorage floats may result in a minor increase in vessels being moored, however are unlikely to increase the overall vessel traffic because of the adjacent parking area and boat launch ramp available to those without moorage. The increase in the likelihood of vessel interactions will be temporary and occur only during construction due to temporary construction vessels. The new CBJ D&H floats are not likely to result in a permanent increase in vessel traffic.

8 Anticipated Impact on Subsistence

Alaska Native hunters in the north Juneau-Auke Bay vicinity do not traditionally harvest humpback whales. Steller sea lion have been traditionally hunted by Alaska Natives in Southeast Alaska for food and material products such as meat, skins, and whiskers (for art and regalia). Active hunting continues in the western Gulf of Alaska region of the wDPS range, but very few sea lions are harvested in Southeast Alaska in recent years (Wolfe *et al.* 2012, L. Sill pers. comm. 2017). Most sea lion harvests occur in winter months. In 2012, all nine of nine sea lions harvested in Southeast Alaska were male (Wolfe *et al.* 2012). Harbor seal, however, remain highly prized for rendering oil, fat, meat, and skins for cultural uses and are actively hunted in the Auke Bay project vicinity (K. Lindoff pers. comm. 2017, M. Miller pers. comm. 2017).

Records on Steller sea lion total subsistence takes includes kills plus struck and lost animals. Subsistence reports do not attribute the animals to eastern or western stocks of Steller sea lion. Impacts of subsistence hunting on the endangered western stock can only be coarsely inferred by applying the estimated percent of wDPS animals in northern Southeast Alaska (2%) to harvest numbers described below, but this estimate should not be construed as a take of endangered Steller sea lions without applying appropriate demographic, DNA and other parameters to the calculus.

Alaska Department of Fish and Game subsistence data show that from 1992 through 2008, plus 2012, from zero to 19 animals were taken by Alaska Native hunters per year (Wolfe *et al.* 2012). The total subsistence sea lion take in these reporting years was an estimated 104 animals, averaging 8 sea lion takes per year (Wolfe *et al.* 2017). Of the total sea lions taken, two were reported taken from the Juneau area: one in 1994 and one in 2006 (Wolfe *et al.* 2012).

Subsequent to the 2012 reporting year through 2017, an estimated 12 or fewer Steller sea lion have been taken annually in all of Southeast Alaska (L. Sill pers. comm. 2017, M. Miller pers. comm. 2017). Up to ten Steller sea lions are taken annually in the Sitka Sound vicinity for meat and hides, and an estimated one to three sea lions are taken in Southeast Alaska communities outside Sitka Sound (L. Sill pers. comm. 2017, M. Miller pers. comm. 2017). There are no reported subsistence takes of sea lion in the Juneau vicinity or in the project area since 2006 (L. Sill 2006).

Harbor seal are hunted by Alaska Native subsistence hunters with about three miles (~5 km) of the project area (K. Lindoff pers. comm. 2017). The Alaska Department of Fish and Game, in partnership with the Alaska Native Harbor Seal Commission and hunters, compile information on subsistence seal harvest through household surveys. Based upon data for harvests in most hunting communities, hunters in Southeast Alaska took from 523 to 719 harbor seals in the years 1992-2008. In 2012 an estimated 595 harbor seals were taken for subsistence uses (Wolfe *et al.* 2012). Seals were harvested across the year, with peak harvests in March, May, and October. Lowest harvests were in December, January, and February.

Most recent reported data indicates that in 2012, an estimated 5 seals were struck and lost, and about 26 harbor seals were harvested for food (Wolfe *et al.* 2012). From 2013 through 2017, Juneau area harbor seal hunting has continued, with several cultural heritage programs teaching students how to harvest, cut and store seal meat.

8.1 Impact on Subsistence Hunting

Juneau area subsistence hunters do not target humpback whales, and very rarely target Steller sea lions; however, local Native communities hunt harbor seal for meat, oil, blubber, and skins. Oceanus Alaska consulted with ADF&G, the Douglas Indian Association, Sealaska Heritage Institute, and the Central Council of the Tlingit and Haida Indian Tribes of Alaska during November and December of 2017 to inquire whether any impacts would be likely from this project.

Chuck Smythe of Sealaska Heritage Institute stated that the primary concern in the project area would be impacts to herring fisheries, not to marine mammals (C. Smythe pers. comm. 2018). As discussed in Section 9.1.2, impacts to fish are anticipated to be localized and temporary in nature, so are not likely to impact herring fisheries further from town. Herring are not a subsistence fishery within the Juneau Nonsubsistence Area, which covers all waters within twenty to forty miles of the project area (5 AAC 99.015(a)(2)).

The proposed project will not result in the death or serious injury of any marine mammal. The project is likely to result only in short-term, temporary impacts to pinnipeds. The proposed project is not likely to adversely impact the availability of any marine mammal species or stocks that are commonly used for subsistence purposes.

8.1.1 Whale Subsistence Hunting in Juneau

Humpback whales may be temporarily displaced from Auke Bay due to Statter Harbor construction activities and barging operations associated with the project. Distances animals are likely to move in response to project activities are anticipated to be less than five kilometers, still a great distance away from any known active subsistence whale hunting regions. Thus, there is no impact to subsistence hunting in Juneau.

8.1.2 Steller Sea Lion Subsistence Hunting in Juneau

The proposed project is anticipated to have no long-term impact on Steller sea lion populations or their habitat. Since there is very little sea lion hunting in the Juneau area, short term displacement of animals from the project area is anticipated to have no effect on abundance or availability of Steller sea lions to subsistence hunters.

8.1.3 Harbor Seal Subsistence Hunting in Juneau

Neither the local population nor any individual seal are likely to be adversely impacted by the proposed action beyond noise-induced harassment or slight injury. Temporary displacement and seals being more dispersed from haulout docks and or foraging areas in Auke Bay may increase their vulnerability to predators such as killer whales, potentially reducing the local seal population. Temporary displacement from inner Statter Harbor and Fishermen's Bend or broader dispersal in the Auke Bay vicinity may also increase harbor seal movement to Auke Rec, Indian Point and other sites where they are more accessible to subsistence hunters. This is considered a negligible impact on harbor seal subsistence hunting in the Juneau area (K. Lindoff pers. comm. 2017, C. Smythe pers. comm. 2017).

9 Anticipated Impact on Habitat

Critical habitat is defined as "specific areas within the geographical area occupied by the species at the time of listing, if they contain physical or biological features essential to conservation, and those features may require special management considerations for protection" and "specific areas outside the geographical area occupied by the species if the agency determines that the area itself is essential for conservation." Critical habitat typically supports unique foraging, refugia, or reproductive habitat features.

The project area does not occur within critical habitat for Steller sea lions or humpback whales. Physical impacts to habitat are anticipated to be temporary.

9.1.1 Direct Impacts

The primary reason that animals would leave habitats in the project area would be due to elevated noise levels and an increase in turbidity during dredge and dredge disposal activities.

Construction activities will likely have temporary impacts on Steller sea lion and harbor seal habitat through increases in underwater and airborne sound from pile removal and dredging. Project-related disturbances will not be detectable at the nearest known Steller sea lion haulouts.

Harbor seals are known to haul out on the nearby floats at Fishermen's Bend and construction noise may impact marine mammals in this area. Direct effects of construction noise in this area will be partially blocked by the recently constructed Phase II boat launch and parking area.

Effects will be short-term and are not anticipated to extend significantly beyond the construction phase of the project. The level of disturbance and habitat alteration in the project area will be insignificant and discountable, especially when considered in relation to activities already taking place in the project area and the apparent tolerance of the Steller sea lions and harbor seals to these activities. Best management practices and mitigation used to minimize potential environmental effects from project activities are described in Section 1.3.

While it is possible that pinnipeds and cetaceans may avoid the project area during construction, they are not likely to abandon the site altogether. Despite current background noise levels and facility activities, nearby dock facilities often attract pinnipeds and other marine mammals to Auke Bay due to the availability of prey. It is also not uncommon for commercial, subsistence, and sport fishermen to clean fish within the marine waters around Juneau, providing additional enticements.

9.1.2 Indirect Impacts

Indirect effects to marine mammals, such as noise-induced dispersal or disaggregation of prey, would be insignificant and discountable due to the temporary nature of the activity. After activities cease each day, it is expected that forage fish will re-aggregate and become more available.

Dredge disposal will result in the burial of deep estuary benthic habitat that contributes to flatfish habitat, a prey species: a temporary affect, as the disposed sediments will recolonize and contribute to benthic habitat within an estimated two years. Removal of coastal fish spawning and zooplankton aggregation habitats in the nearshore shallows of Auke Bay will likely affect those microorganisms, but with no baseline data on their abundance, this will likely be an imperceptible impact of the project upon the prey food web.

9.1.3 Cumulative Impacts

The sum of these effects is not expected to adversely modify habitat or jeopardize the local populations of marine mammals. No critical habitat has been designated in the action area.

10 Anticipated Impact of Loss or Modification of Habitat

The proposed project is not likely to result in the permanent loss or modification of Steller sea lion, harbor seal, or humpback whale habitat.

11 Mitigation Measures

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

11.1 All Construction Activities

The proposed project avoids impacts as much as practicable, but impacts cannot be avoided entirely as this project is dependent on maritime access by nature. The following measures and BMPs will be incorporated by the applicant in order to minimize potential impacts:

- The harbor improvements will be maintained in a manner that does not introduce any pollutants or debris into the harbor or cause a migration barrier for fish.
- The harbor improvement structures are designed to limit contaminant releases and will be maintained in a manner that manages pollutants and debris streams to avoid incidental introduction of deleterious materials into Auke Bay.
- Harbor improvement structures were designed to provide barrier-free migration and vertical movement for marine and estuarine fish in Auke Bay.
- Fuels, lubricants, chemicals and other hazardous substances will be stored above the high tide line to prevent spills.
- Oil booms will be readily available for containment should any releases occur.
- To prevent spills or leakage of hazardous material during construction, standard spill-prevention measures will be implemented during construction. The Contractor will provide and maintain a spill clean-up kit on-site at all times.
- The contractor will monitor equipment and gear storage areas for drips or leaks regularly, including inspection of fuel hoses, oil drums, oil or fuel transfer valves and fittings, and fuel storage that occurs at the project site. Equipment will be maintained and stored properly to prevent spills.
- During construction, activities which may attract marine mammals such as fish cleaning and carcass disposal will be managed in concert with the CBJ D&H staff to eliminate mammal attractants to the project area where possible.
- If contaminated or hazardous materials are encountered during construction, all work in the vicinity of the contaminated site will be stopped until a corrective action plan is devised and implemented to minimize impacts on surface waters and organisms in the project area.
- To minimize impacts to pink and chum salmon fry and coho and Chinook salmon smolt, and Douglas Island Pink and Chum, Inc. hatchery net pen species in Auke Bay, contractors will refrain from blasting and dredging activities from May 1 through June 30.

11.2 Soft Start Procedures

Soft start procedures shall be used prior to pile removal to allow marine mammals to leave the area prior to exposure to maximum noise levels. For vibratory hammers, the contractor shall run the vibratory hammer for no more than 30 seconds followed by a quiet period of at least 60 seconds without vibratory removal of piles. The process shall be repeated twice more within 10 minutes before beginning vibratory removal operations that last longer than 30 seconds. For other heavy equipment operating from barges or nearshore, the equipment will be idled for 15 minutes prior to operation. If work ceases for more than 30 minutes, soft start procedures must recommence prior to performing additional work.

11.3 Silt Curtain

A silt curtain is not feasible for this project. The dredge disposal barge must be able to enter and leave the site on a regular basis. Silt curtains are extremely heavy and difficult to move and cannot readily be moved or separated to allow for access. Even if the curtain could be repositioned to allow for dredge disposal dumping, doing so would release the contained sediment.

11.4 Observation and Shutdown Procedures

Qualified observers with stop-work authority will be on site before and during any in-water or over-water construction. Observers will monitor permitted activities in accordance with protocols reviewed and approved by NMFS. At least the minimum number of observers necessary to view the entire monitoring area, depending on construction activities, environmental conditions, and harbor activities will be onsite. A detailed MMMP is found in Appendix B.

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

11.5 Blasting

Qualified observers will be on site before and during each of the blasts. Emplacement of blasting charges will not occur if species not authorized by this IHA are observed with the potential to enter the shutdown zone. The presence of non-permitted species within unauthorized hazard radii at the time of detonation is considered highly unlikely due to the mitigation measures proposed, including observation and emplacement delay.

All permitted species that come within the Level B harassment zone for blasting at the time of detonation will be recorded as potential exposures. Detonation will be delayed as long as possible if harbor seals or sea lions are within the range of Level A harassment zone, however detonation will not be postponed beyond the window of safety for charge stability (assumed to be sunset of the day of placement, as detonation cannot be performed after dark).

11.6 In-Water or Over-Water Construction Activities

During all in-water or over-water construction activities having the potential to affect marine mammals, a shutdown zone of 10 meters will be monitored to ensure that marine mammals are not endangered by physical interaction with construction equipment.

11.7 Vessel Interactions

The dredge disposal site is located just outside of the 5-mph zone and thus the barge will be restricted to slow speeds further reducing the risk of strikes.

In order to minimize impacts from vessel interactions with marine mammals, the crews aboard project vessels will follow NMFS's marine mammal viewing guidelines and regulations as practicable. (https://alaskafisheries.noaa.gov/protectedresources/mmv/guide.htm).

11.8 Compensatory Habitat Mitigation

CBJ D&H has requested a permit for the proposed project under Section 404 of the Clean Water Act and Section 10 of the Rivers and Harbors Act from the USACE. To receive that permit, CBJ D&H will be required to avoid, minimize, and mitigate impacts to intertidal habitat. For impacts that cannot be avoided or minimized, CBJ D&H will coordinate compensatory mitigation with USACE.

12 Arctic Subsistence Uses, Plan of Cooperation

This section is not applicable to the proposed project. The project will take place in Juneau, which is located in waters south of the 60° North latitude demarcation. No activities will take place in or near a traditional Arctic subsistence hunting area.

13 Monitoring and Reporting Plans

13.1 Monitoring Plan

Monitoring measures for the potential impacts the project could have on marine mammals are discussed briefly in Section 11 and at length in the MMMP (Appendix B).

13.2 Reporting

The procedures for reporting are listed below and in the MMMP (Appendix B).

13.2.1 Annual Report

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

The reports shall include at a minimum:

- General data:
  - Date and time of activity
  - Water conditions (e.g., sea-state)
  - Weather conditions (e.g., percent cover, percent glare, visibility)
- 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 in-water construction is delayed due to presence of marine mammals within shutdown zones.
- During-activity observational survey-specific data:
  - Description of any observable marine mammal behavior within monitoring zones or in the immediate area surrounding the monitoring zones, including the following:
    - Distance from animal to sound source.
    - Reason why/why not shutdown implemented.
    - If a shutdown was implemented, behavioral reactions noted and if they occurred before or after implementation of the shutdown.
    - If a shutdown was implemented, the distance from animal to sound source at the time of the shutdown.
    - Behavioral reactions noted during soft starts and if they occurred before or after implementation of the soft start.
    - Distance to the animal from the sound source during soft start.

- Post-activity observational survey-specific data:
    - Results, which include the detections and behavioral reactions of marine mammals, the species and numbers observed, sighting rates and distances,
    - Refined exposure estimate based on the number of marine mammals observed. This may be reported as a rate of take (number of marine mammals per hour or per day) or using some other appropriate metric.

14 Coordinating Research to Reduce and Evaluate Incidental Take

The data recorded during marine mammal monitoring for the proposed project will be provided to NMFS in monitoring reports. These reports will provide information on the usage of the site by Steller sea lions, harbor seals, and humpback whales. The monitoring data will inform NMFS and future permit applicants about the behavior and adaptability of pinnipeds and cetaceans for future projects of a similar nature.

15 Conclusion

For the reasons described in this document, CBJ D&H has determined that the proposed project is likely to result in the Level B harassment of Steller sea lions, harbor seals, and humpback whales and may result in the Level A harassment of Steller sea lions and harbor seals. This project has implemented impact minimization measures, including a Marine Mammal Monitoring Plan, to reduce the potential for unauthorized harassment.

While the project has the potential to result in minor behavioral effects or minor injury to any marine mammals present during project activities, based on the analysis presented in this document, these individual impacts will have a negligible effect on the stocks of marine mammals described in this document or on their habitats.

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16.1 Personal Communications

Bishop, A. 2017. Personal Communication: Alicia Bishop, ESA Section 7, Protected Resources Division, Alaska Region, NOAA-NMFS, Juneau, Alaska 99801. Telephone communication: July 7, 2017 – January 29, 2018. Email exchanges: August 10, 2017 - January 29, 2018.

Eaton, W. 1992. Personal Communication: Dr. Bill Eaton, University of Alaska Fairbanks, School of Fisheries and Ocean Sciences. In-person conversation with Michelle Ridgway 1992

Fritz, L. 2017. Personal Communication: Dr. Lowell Fritz, Fisheries Biologist, Alaska Fishery Science Center, NOAA-NMFS, Seattle, Washington. Telephone December 6, 2017; Email exchange Dec. 6-8, 2017.

Jemison, L. 2017. Personal Communication: Lauri Jemison, Marine Mammal Biologist, Alaska Department of Fish and Game, Juneau, Alaska 99801 In-person meeting November 13, 2017; Email exchanges November 15 – February 2, 2018 with Michelle Ridgway and Bre Austin.

Kurland, J. 2017. Personal Communication: John Kurland, Assistant Regional Administrator, Protected Resources Division, NOAA-NMFS, Juneau, Alaska 99081. In-person meeting: November 14, 2017; Telephone Conversation: December 6, 2017.

Miller, M. 2017. Personal Communication: Mike Miller, Chairman, Alaska Native Marine Mammal Commission, Sitka, Alaska 99835 Email/text exchange: December 5-8, 2017.

Moran, J. 2017. Personal Communication: John Moran, Marine Mammal Biologist, Ted Stevens Marine Research Institute, NOAA-NMFS, Juneau, Alaska 99801. Email exchange: Dec 6-8, 2017.

Raum-Suryan, K. 2017. Personal Communication: Kim Raum-Suryan, Pinniped entanglement group coordinator, co-management, ESA Section 7, Protected Resource Division, NOAA-NMFS, Juneau, 99801. Telephone conversations: December 4-5, 2017

Savage, K. 2017. Personal Communication: Kate Savage, Marine Mammal Veterinarian/NOAA Stranding Network Coordinator Alaska Region. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Protect Resources Division. Juneau, Alaska 99801. In-person meeting: November 12, 2017; Email exchange: December 8, 2017

Sill, L. 2017. Personal Communication: Lauren Sill, Subsistence Data Manager, Alaska Department of Fish and Game Subsistence Division Telephone November 5, 2017; Email exchange December 7-8, 2017.

Smythe, C. 2017 Personal Communication: Chuck Smythe, History and Culture Director, Sealaska Heritage Institute. Juneau, Alaska 99801. Conversation with M. Ridgway. Follow-up conversation with B. Hughes (PND Engineers; May, 2018)

Stone, B. 2017. Personal Communication: Bob Stone, Marine Biologist, Ted Stevens Marine Research Institute, NOAA-NMFS, Juneau, Alaska 99801. Email exchange: December 6-8, 2017

Wright, S. 2017. Personal Communication: Sadie Wright, Wildlife Biologist – ESA Section 7, Protected Resources Division, Alaska Region, NOAA-NMFS, Juneau, Alaska. Email exchange: Dec. 6-8, 2017

Wynne, K. 2017. Personal Communication: Kate Wynne, Chair, Alaska Scientific Review Group. NOAA-NMFS, Seattle, Washington Email exchange: November 5- December 6, 2017.

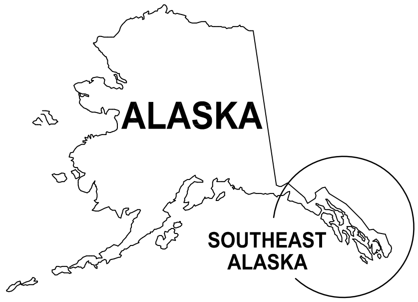
16.2 Auke Bay Marine Mammal Observation Record Sources

No quantitative agency data or reports on marine mammals in Auke Bay are available at the time of this writing. Written observation data were provided by Oceanus Alaska. Additional observation records augmented the time series for every species. Photographs, video and time link data were used to augment written records. The following individuals and entities contributed to the Auke Bay marine mammal data summary provided herein:

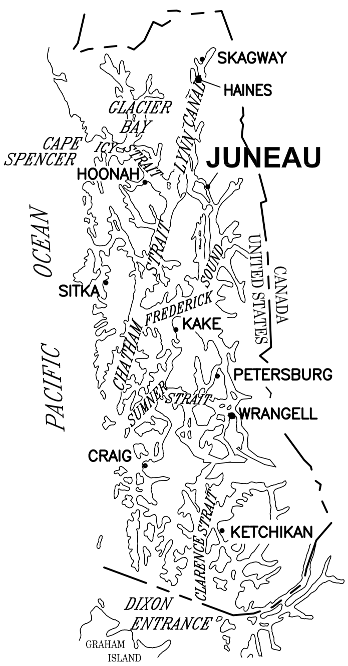
Jos Bakker, Jos Bakker Photography
Robert Armstrong, Nature Bob
Patty Rose, Audubon Society Juneau
Dr. Terrance Quinn III, University of Alaska Fairbanks
Suzie Teerlink, NOAA National Marine Fisheries Service
Doug Jones, Naturalist
Michelle Ridgway, Oceanus Alaska
Kate Wynne, University of Alaska Fairbanks Professor Emeritus, and Chair,
NOAA Alaska Region Marine Mammal Stock Review Group
Dr. Heidi Pearson & Students, University of Alaska Southeast
Ms. Kerry Howard, Photographer
Dr. Richard Carlson, NOAA National Marine Fisheries Service
Dr. Richard Haight, NOAA National Marine Fisheries Service
Lauri Jemison, Alaska Department of Fish and Game
Dr. Jamie Womble, National Park Service, Alaska
Ms. Lorainne Lorainne

John Moran, NOAA National Marine Fisheries Service
Ron Heintz, NOAA National Marine Fisheries Service.

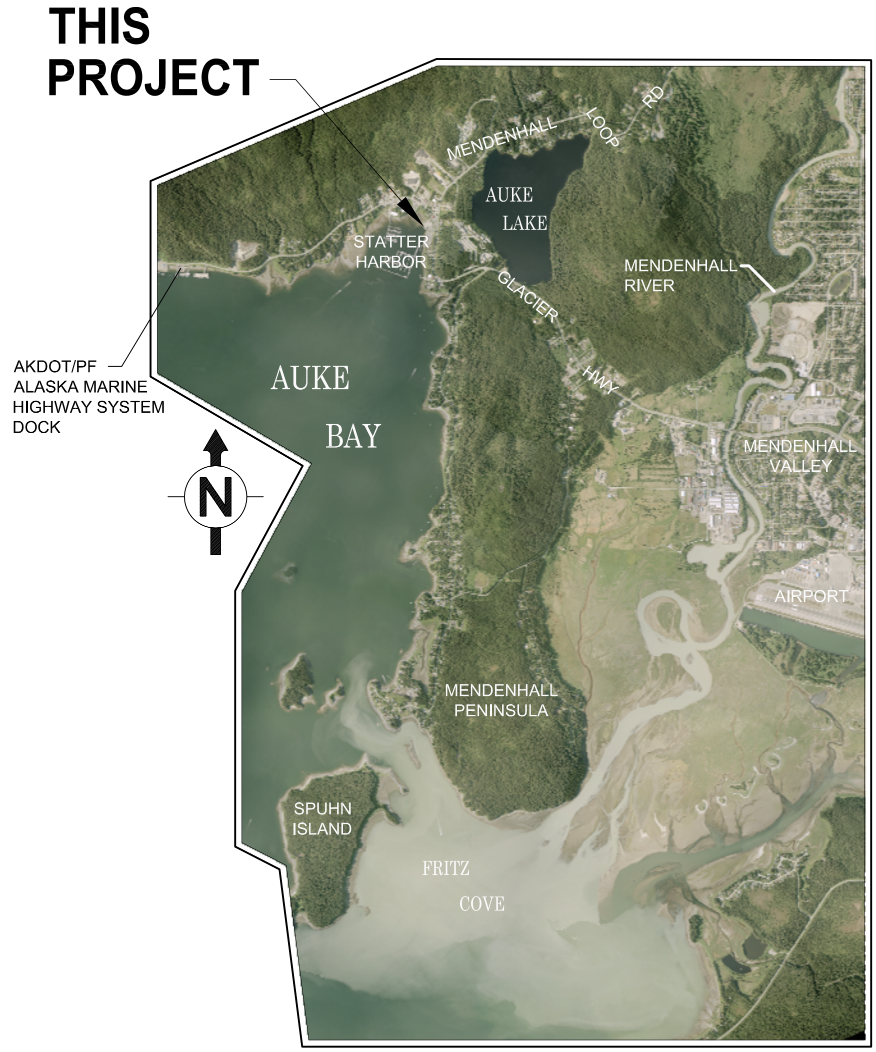
Appendix A. Project Permit Drawings



LOCATION MAP



SOUTHEAST ALASKA



AERIAL PHOTO FROM:
CITY AND BOROUGH OF JUNEAU, 2006

TIDAL DATA	
MAX. OBS	24.82'
HTL	20.3'
MHW	15.34'
MLW	+1.6'
MLLW	0.0'
MIN. OBS	−5.89'

DATA REFERENCED FROM:
NOAA STATION 9452210
JUNEAU, ALASKA 2014

VICINITY MAP

SCALE IN MILES

0 1 2

PURPOSE:

THE PROJECT PURPOSE IS TO IMPROVE SAFETY AND REDUCE CONGESTION BY INCREASING HARBOR EFFICIENCY THROUGH INCORPORATION OF IMPROVEMENT PLANS IDENTIFIED IN THE STATTER HARBOR MASTER PLAN.

DATUM:

MLLW = 0.0' HTL = 20.3'

VICINITY MAP

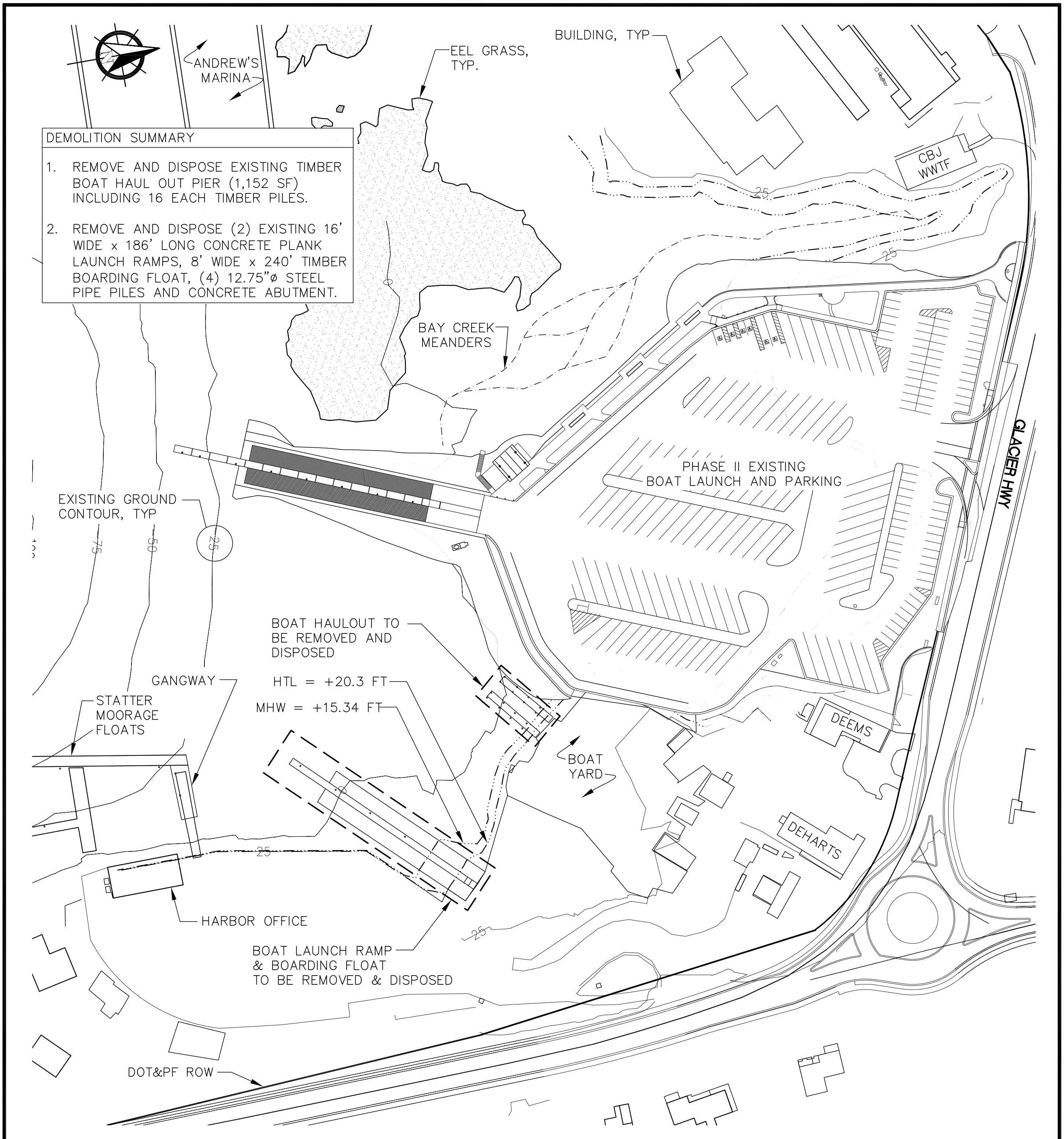
PND PROJECT NO. 152069

STATTER HARBOR IMPROVEMENTS PHASE III

APPLICANT: CITY AND BOROUGH JUNEAU/ DOCKS AND HARBORS
FILE NO.:
WATERWAY: AUKE BAY
PROPOSED ACTIVITY: HARBOR IMPROVEMENTS
SEC. 23 **T.** 40 S **R.** 65 E **M** COPPER RIVER MERIDIAN
LAT.: 58.3852° N **LONG.:** 134.6461° W
DATE: MAY 2017

DEMOLITION SUMMARY

1. REMOVE AND DISPOSE EXISTING TIMBER BOAT HAUL OUT PIER (1,152 SF) INCLUDING 16 EACH TIMBER PILES.
2. REMOVE AND DISPOSE (2) EXISTING 16' WIDE x 186' LONG CONCRETE PLANK LAUNCH RAMPS, 8' WIDE x 240' TIMBER BOARDING FLOAT, (4) 12.75"ø STEEL PIPE PILES AND CONCRETE ABUTMENT.



PURPOSE:

THE PROJECT PURPOSE IS TO IMPROVE SAFETY AND REDUCE CONGESTION BY INCREASING HARBOR EFFICIENCY THROUGH INCORPORATION OF IMPROVEMENT PLANS IDENTIFIED IN THE STATTER HARBOR MASTER PLAN.

DATUM:

MLLW = 0.0'   HTL = 20.3'

EXISTING CONDITIONS DEMOLITION PLAN

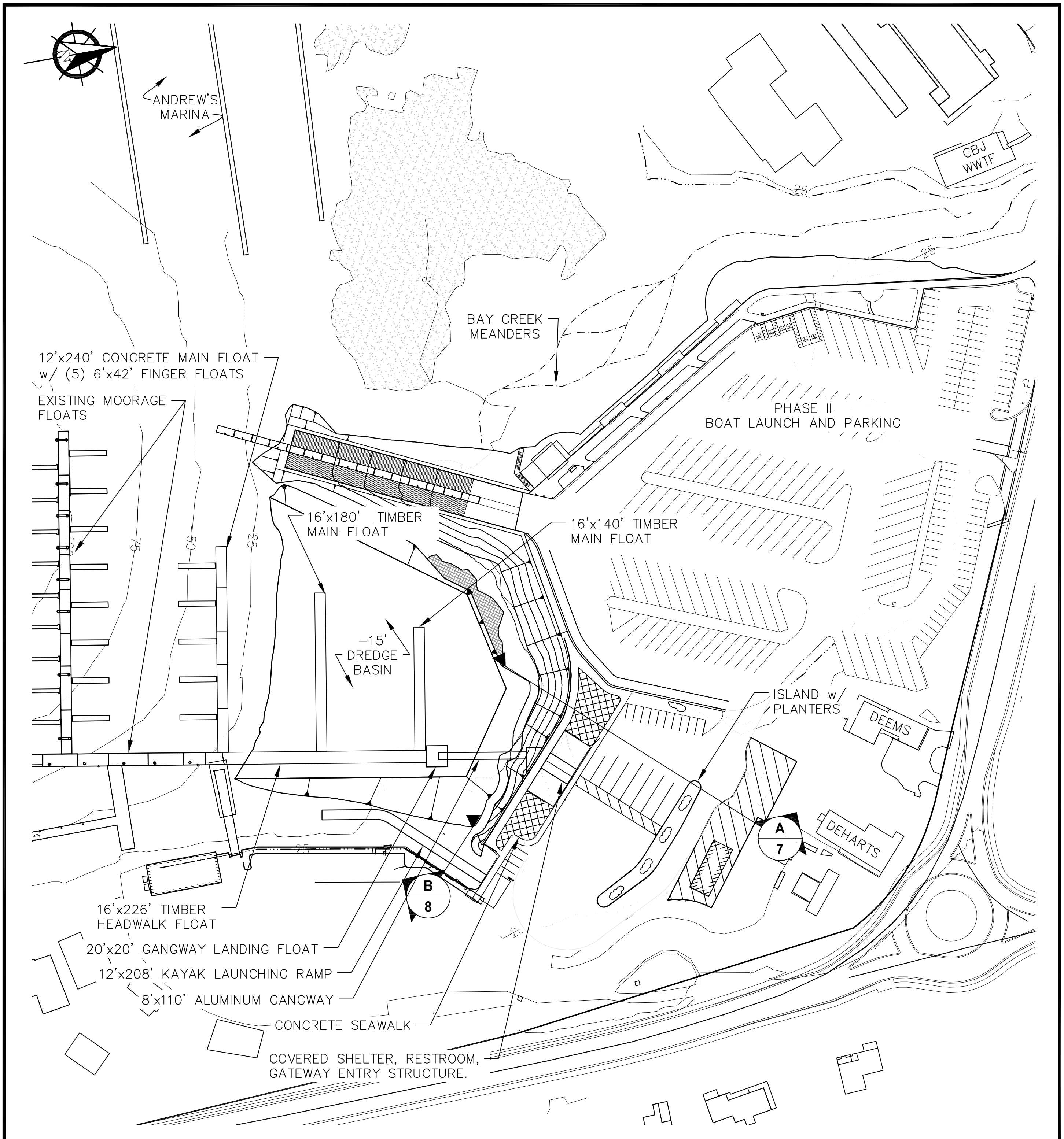
SCALE IN FEET
0   80   160 FT.

PND PROJECT NO. 152069

STATTER HARBOR IMPROVEMENTS PHASE III

APPLICANT: CITY AND BOROUGH JUNEAU/ DOCKS AND HARBORS
FILE NO.:
WATERWAY: AUKE BAY
PROPOSED ACTIVITY: HARBOR IMPROVEMENTS
SEC. 23 **T.** 40 S **R.** 65 E **M** COPPER RIVER MERIDIAN
LAT.: 58.3852° N   **LONG.:** 134.6461° W
DATE: MAY 2017

SHEET **2** of **13**



PURPOSE:

THE PROJECT PURPOSE IS TO IMPROVE SAFETY AND REDUCE CONGESTION BY INCREASING HARBOR EFFICIENCY THROUGH INCORPORATION OF IMPROVEMENT PLANS IDENTIFIED IN THE STATTER HARBOR MASTER PLAN.

DATUM:

MLLW = 0.0' HTL = 20.3'

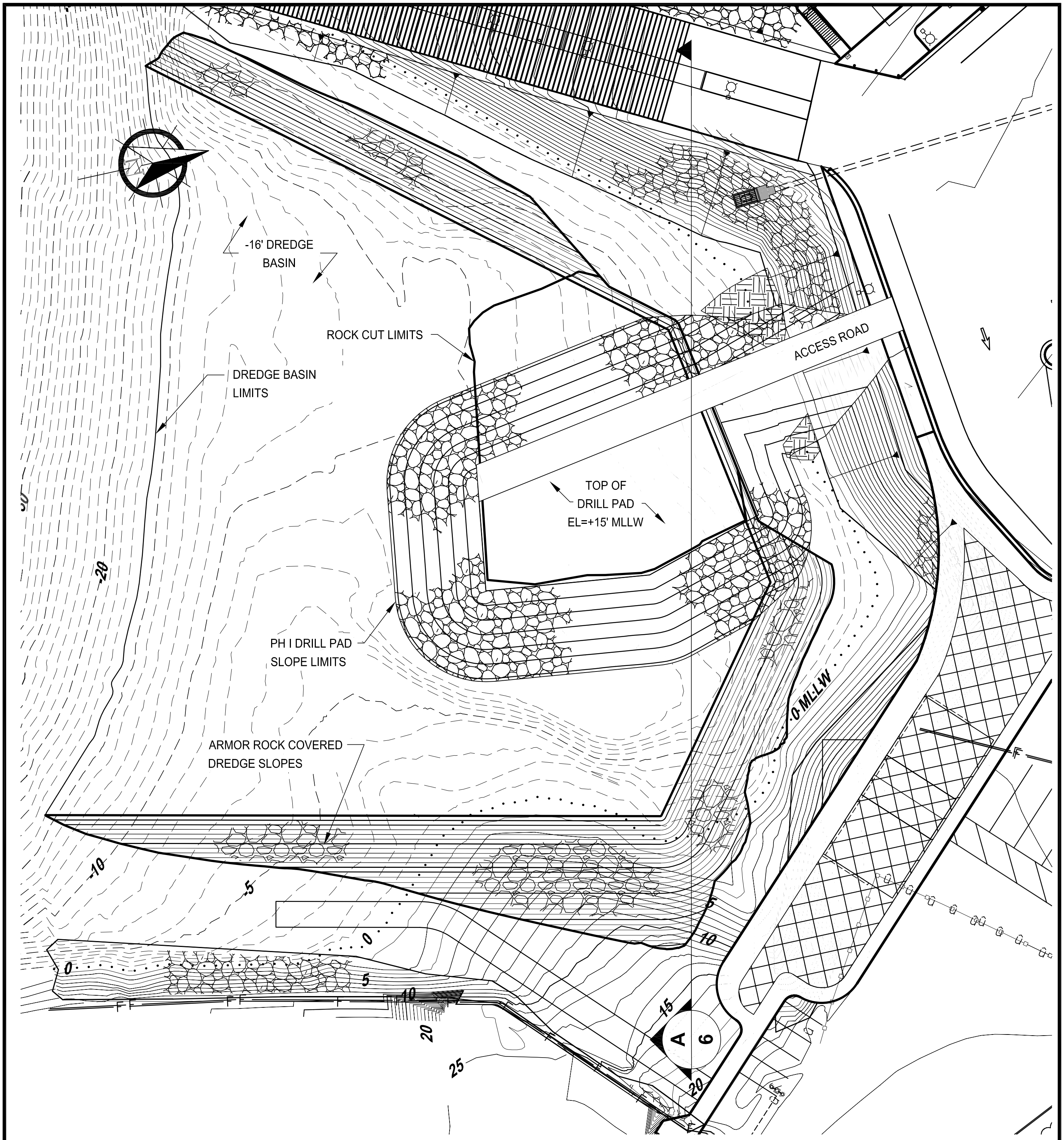
GENERAL SITE PLAN

SCALE IN FEET
0 80 160 FT.

PND PROJECT NO. 152069

STATTER HARBOR IMPROVEMENTS PHASE III

APPLICANT: CITY AND BOROUGH JUNEAU/ DOCKS AND HARBORS
FILE NO.:
WATERWAY: AUKE BAY
PROPOSED ACTIVITY: HARBOR IMPROVEMENTS
SEC. 23 **T.** 40 S **R.** 65 E **M** COPPER RIVER MERIDIAN
LAT.: 58.3852° N **LONG.:** 134.6461° W
DATE: MAY 2017



PURPOSE:

THE PROJECT PURPOSE IS TO IMPROVE SAFETY AND REDUCE CONGESTION BY INCREASING HARBOR EFFICIENCY THROUGH INCORPORATION OF IMPROVEMENT PLANS IDENTIFIED IN THE STATTER HARBOR MASTER PLAN.

DATUM:

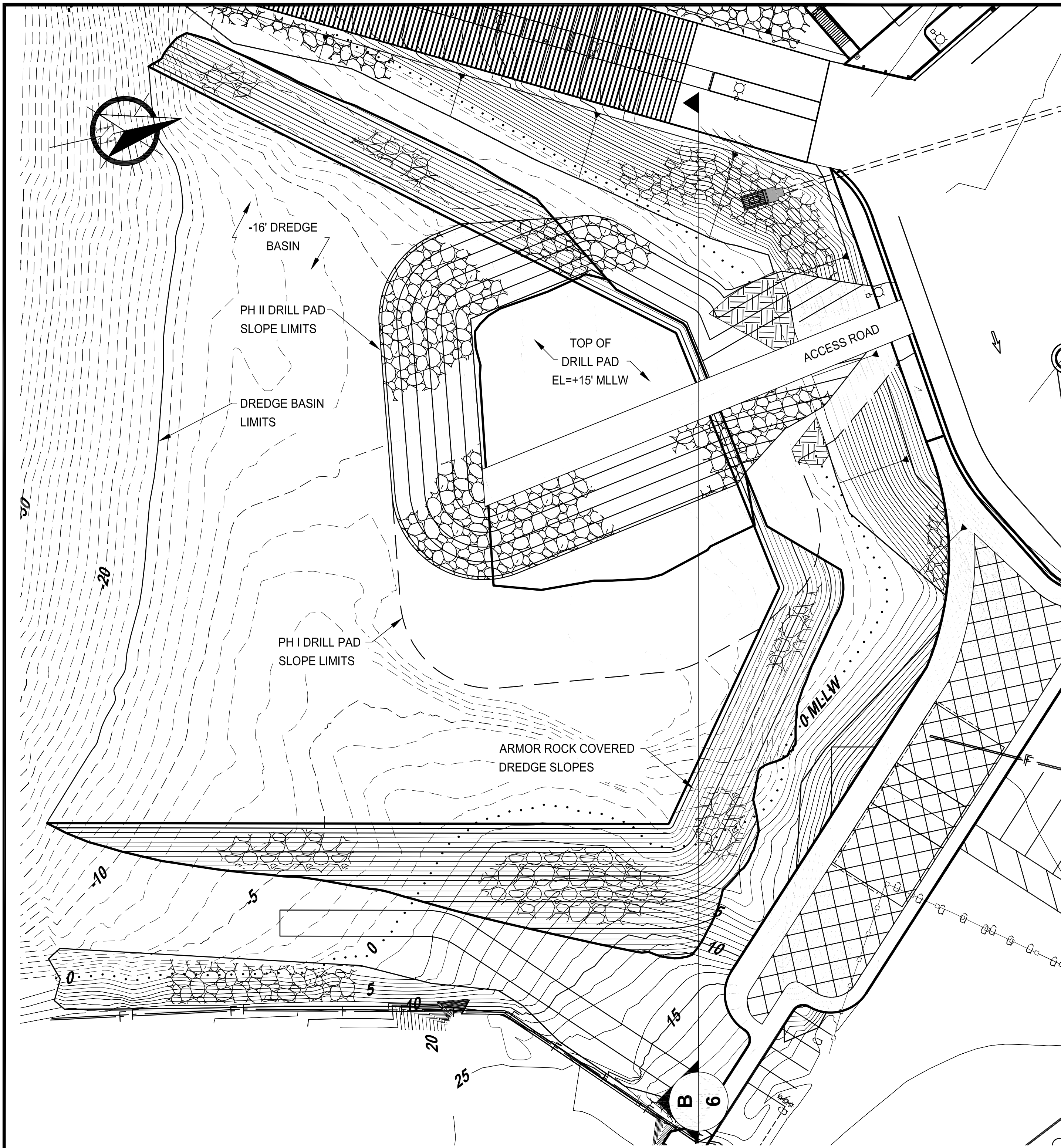
MLLW = 0.0'   HTL = 20.3'

ROCK CUT SITE PLAN
PHASE I

PND PROJECT NO. 152069

STATTER HARBOR IMPROVEMENTS PHASE III

APPLICANT: CITY AND BOROUGH JUNEAU/ DOCKS AND HARBORS
FILE NO.:
WATERWAY: AUKE BAY
PROPOSED ACTIVITY: HARBOR IMPROVEMENTS
SEC. 23 T. 40 S R. 65 E M COPPER RIVER MERIDIAN
LAT.: 58.3852° N   LONG.: 134.6461° W
DATE: MAY 2017



PURPOSE:

THE PROJECT PURPOSE IS TO IMPROVE SAFETY AND REDUCE CONGESTION BY INCREASING HARBOR EFFICIENCY THROUGH INCORPORATION OF IMPROVEMENT PLANS IDENTIFIED IN THE STATTER HARBOR MASTER PLAN.

DATUM:

MLLW = 0.0' HTL = 20.3'

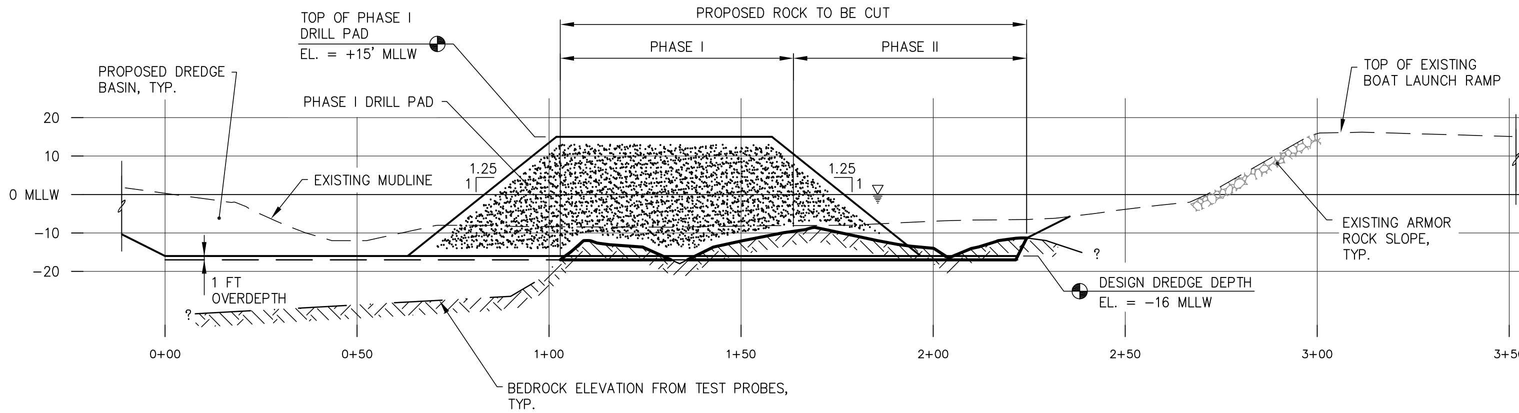
ROCK CUT SITE PLAN

PHASE II

PND PROJECT NO. 152069

STATTER HARBOR IMPROVEMENTS PHASE III

APPLICANT: CITY AND BOROUGH JUNEAU/ DOCKS AND HARBORS
FILE NO.:
WATERWAY: AUKE BAY
PROPOSED ACTIVITY: HARBOR IMPROVEMENTS
SEC. 23 **T.** 40 S **R.** 65 E **M** COPPER RIVER MERIDIAN
LAT.: 58.3852° N **LONG.:** 134.6461° W
DATE: MAY 2017



A
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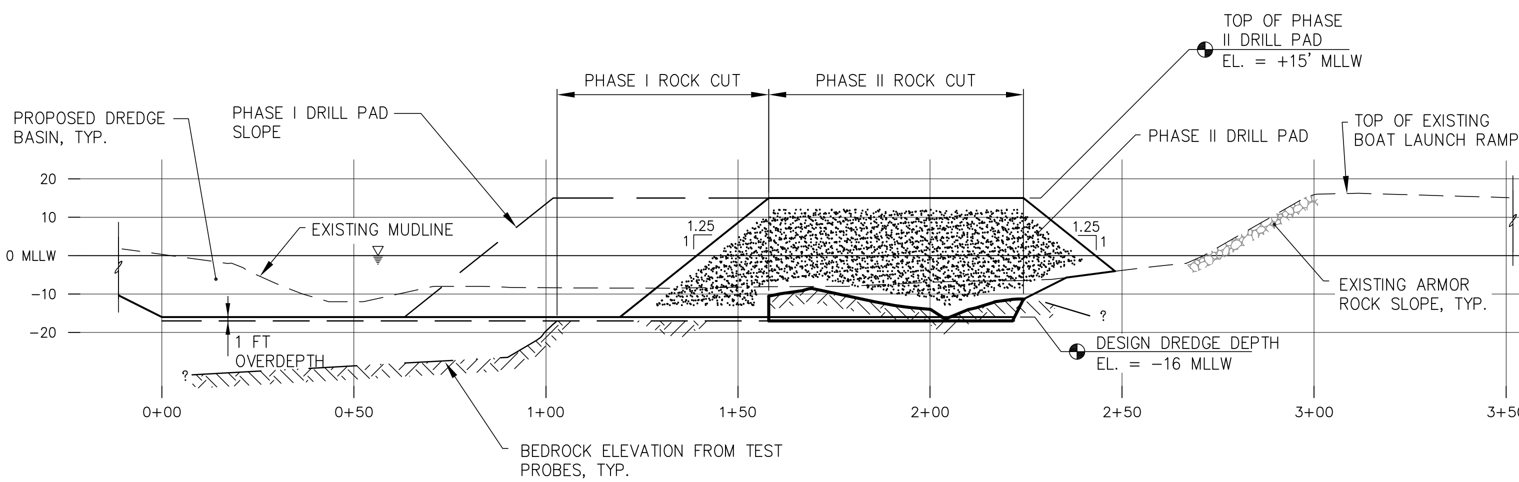
PROFILE WITH PHASE I DRILL PAD - VIEW SOUTH



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PROFILE WITH PHASE II DRILL PAD - VIEW SOUTH

PURPOSE:
THE PROJECT PURPOSE IS TO IMPROVE SAFETY AND REDUCE CONGESTION BY INCREASING HARBOR EFFICIENCY THROUGH INCORPORATION OF IMPROVEMENT PLANS IDENTIFIED IN THE STATTER HARBOR MASTER PLAN.

DATUM:
MLLW = 0.0' HTL = 20.3'

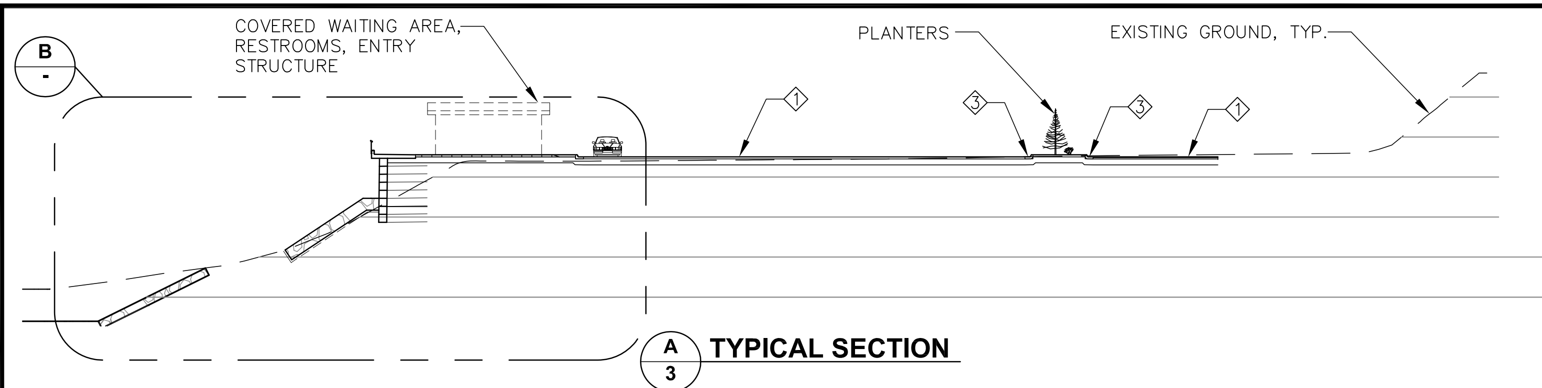
GENERAL SITE PLAN

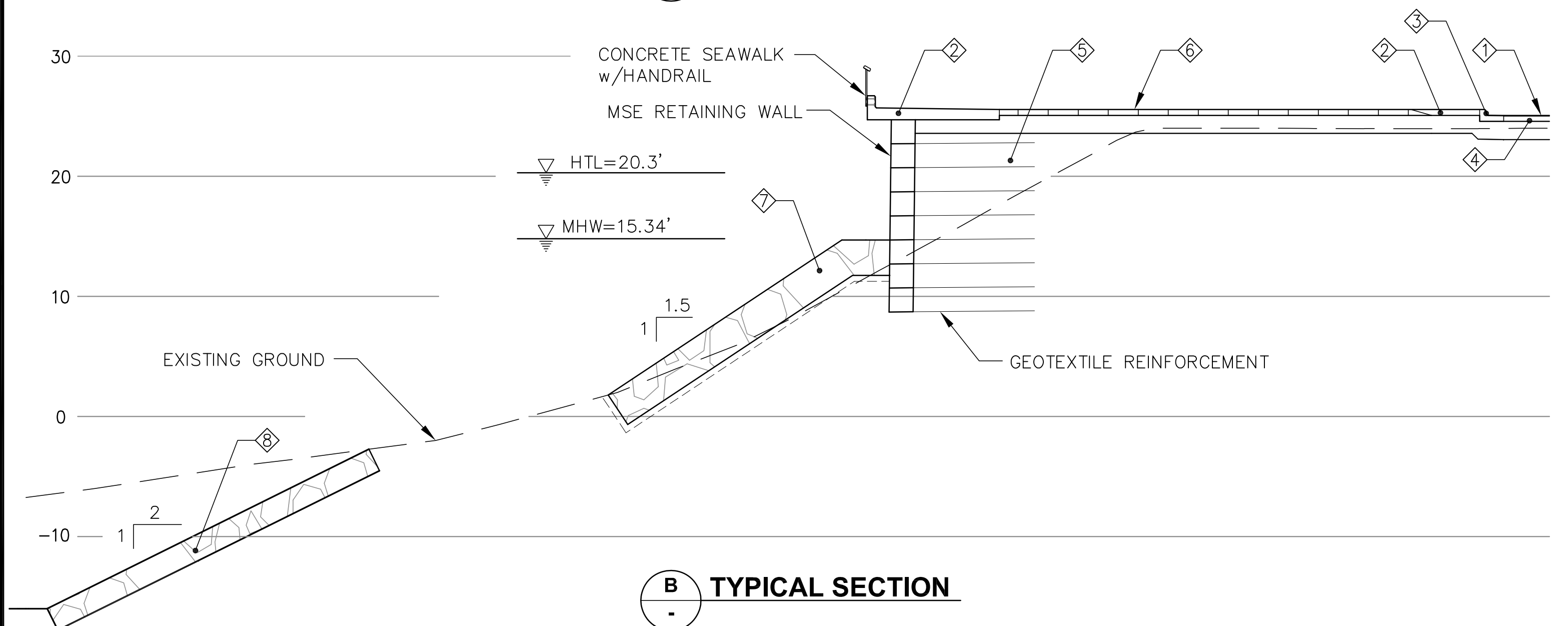
SCALE IN FEET
0 80 160 FT.

PND PROJECT NO. 152069

STATTER HARBOR IMPROVEMENTS PHASE III

APPLICANT: CITY AND BOROUGH JUNEAU/ DOCKS AND HARBORS
FILE NO.:
WATERWAY: AUKE BAY
PROPOSED ACTIVITY: HARBOR IMPROVEMENTS
SEC. 23 **T.** 40 S **R.** 65 E **M** COPPER RIVER MERIDIAN
LAT.: 58.3852° N **LONG.:** 134.6461° W
DATE: MAY 2017





SURVEY CONTROL

PT #	DESCRIPTION	TOTAL PROJECT QTY.	QTY BELOW HTL	QTY SEAWARD OF MHW
1	3"t LAYER ACP	5,300 SQ. YD.	0 SQ.YD.	0 SQ. YD.
2	CONCRETE SEAWALK / SIDEWALK	640 SQ. YD.	0 SQ.YD.	175 SQ. YD.
3	STANDARD CURB & GUTTER	450 LF.	0 LF	0 LF.
4	6" t. LAYER BASE COURSE, GRADING C-1	1,500 CY.	0 CY.	30 CY.
5	SHOT ROCK BORROW, CLASS A	12,000 CY.	6,800 CY.	750 CY.
6	CONCRETE PAVING	560 SQ. YD.	0 SQ.YD.	90 SQ. YD.
7	5' t. LAYER ARMOR ROCK	650 CY.	650 CY.	650 CY.
8	2' t LAYER ARMOR ROCK	1,350 CY.	1,350 CY.	1,350 CY.

PURPOSE:
THE PROJECT PURPOSE IS TO IMPROVE SAFETY AND REDUCE CONGESTION BY INCREASING HARBOR EFFICIENCY THROUGH INCORPORATION OF IMPROVEMENT PLANS IDENTIFIED IN THE STATTER HARBOR MASTER PLAN.

DATUM:
MLLW = 0.0' HTL = 20.3'

TYPICAL SECTION

PND PROJECT NO. 152069

STATTER HARBOR IMPROVEMENTS PHASE III

APPLICANT: CITY AND BOROUGH JUNEAU/ DOCKS AND HARBORS
FILE NO.:
WATERWAY: AUKE BAY
PROPOSED ACTIVITY: HARBOR IMPROVEMENTS
SEC. 23 **T.** 40 S **R.** 65 E **M** COPPER RIVER MERIDIAN
LAT.: 58.3852° N **LONG.:** 134.6461° W
DATE: MAY 2017

SHEET **7** of **13**

PURPOSE:

THE PROJECT PURPOSE IS TO IMPROVE SAFETY AND REDUCE CONGESTION BY INCREASING HARBOR EFFICIENCY THROUGH INCORPORATION OF IMPROVEMENT PLANS IDENTIFIED IN THE STATTER HARBOR MASTER PLAN.

DATUM:

MLLW = 0.0' HTL = 20.3'

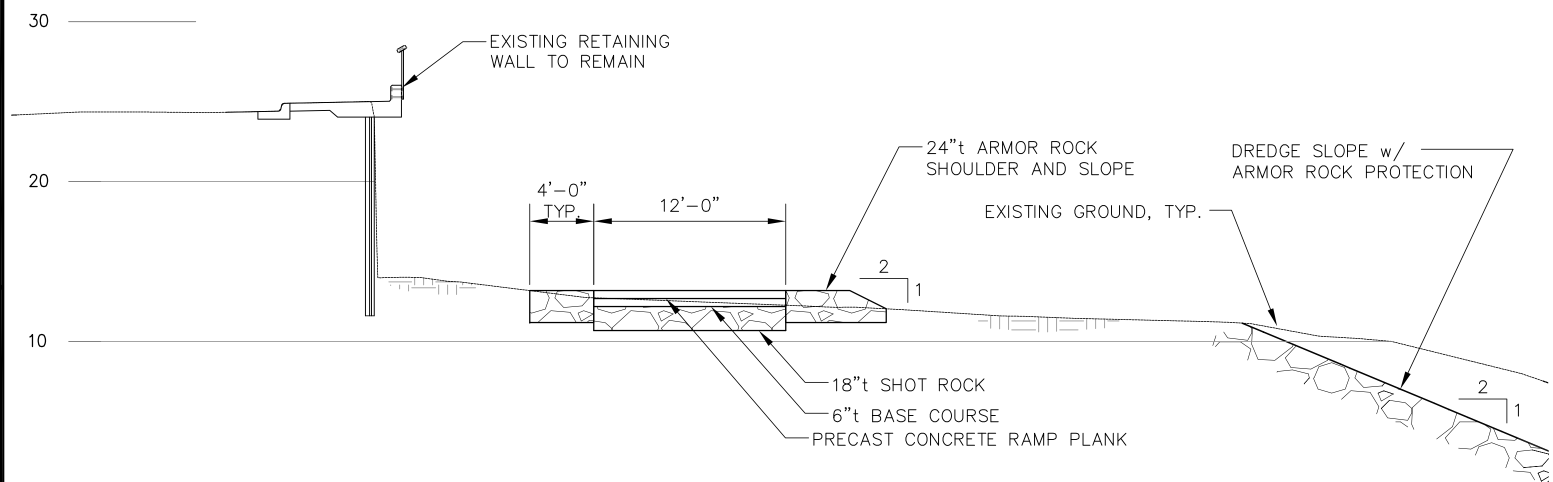
TYPICAL SECTION

PND PROJECT NO. 152069

STATTER HARBOR IMPROVEMENTS PHASE III

APPLICANT: CITY AND BOROUGH JUNEAU/ DOCKS AND HARBORS
FILE NO.:
WATERWAY: AUKE BAY
PROPOSED ACTIVITY: HARBOR IMPROVEMENTS
SEC. 23 **T.** 40 S **R.** 65 E **M** COPPER RIVER MERIDIAN
LAT.: 58.3852° N **LONG.:** 134.6461° W
DATE: MAY 2017

SHEET **8** of **13**



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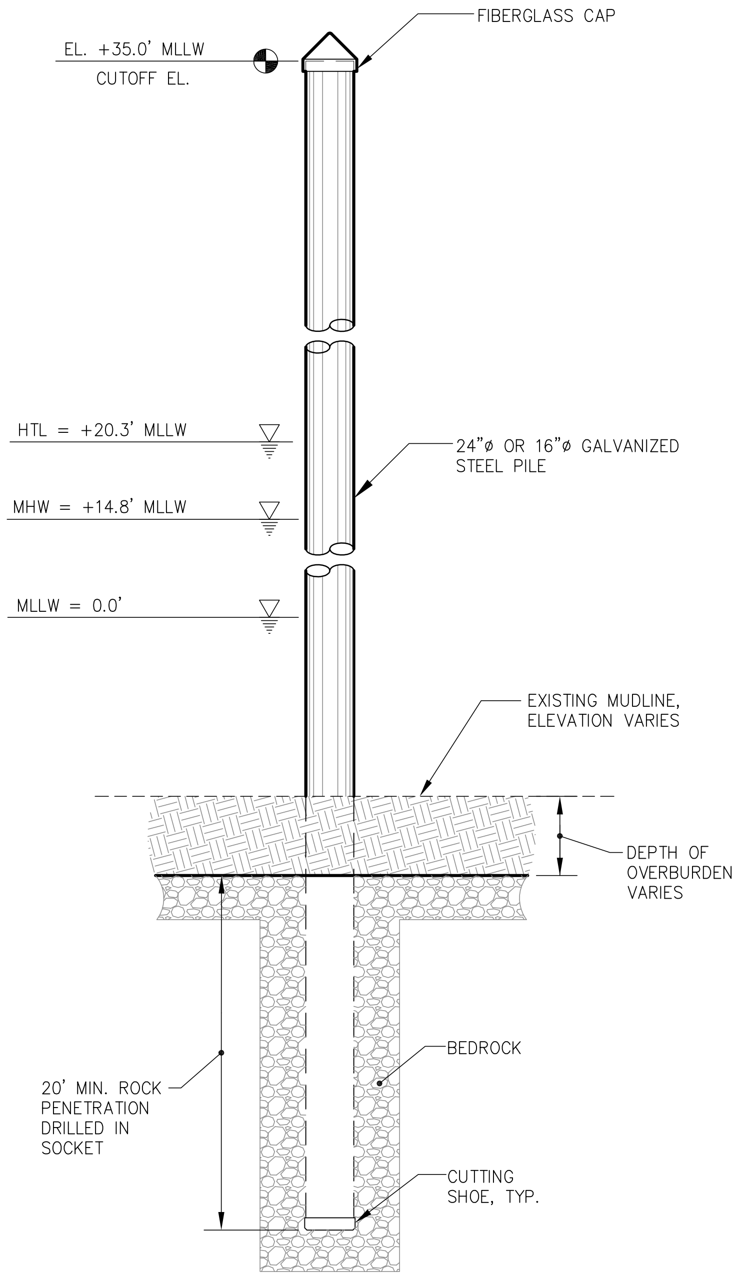
KAYAK LAUNCH TYPICAL SECTION



PURPOSE:

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DATUM:

MLLW = 0.0' HTL = 20.3'

STEEL PIPE PILE DETAILS

PND PROJECT NO. 152069

STATTER HARBOR IMPROVEMENTS PHASE III

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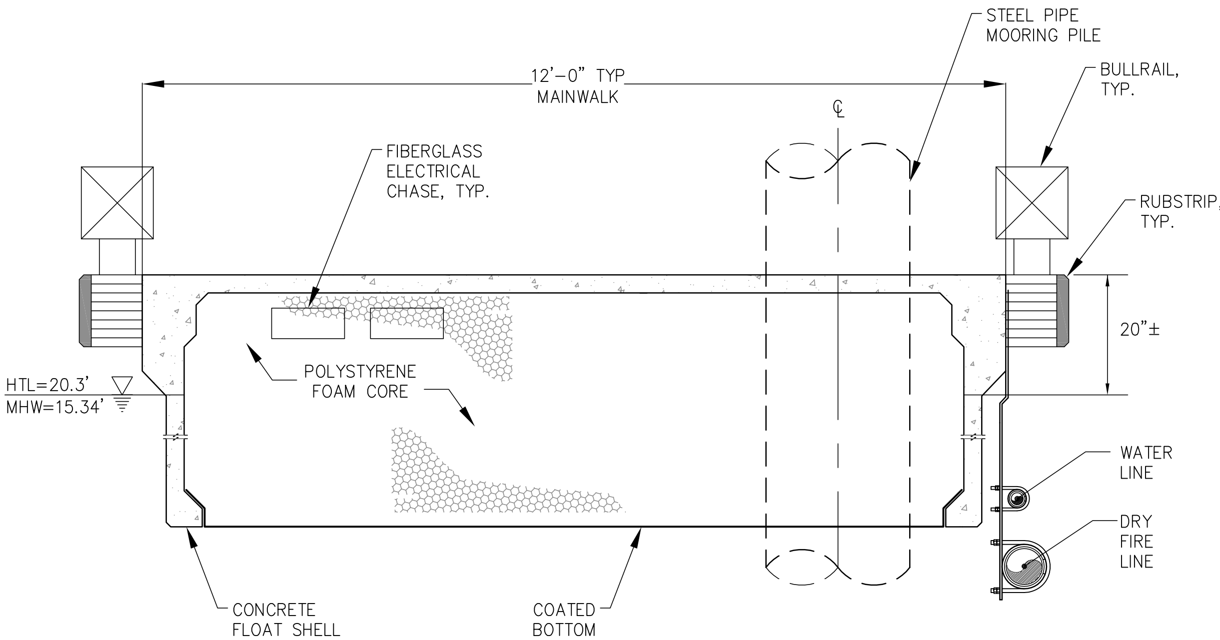
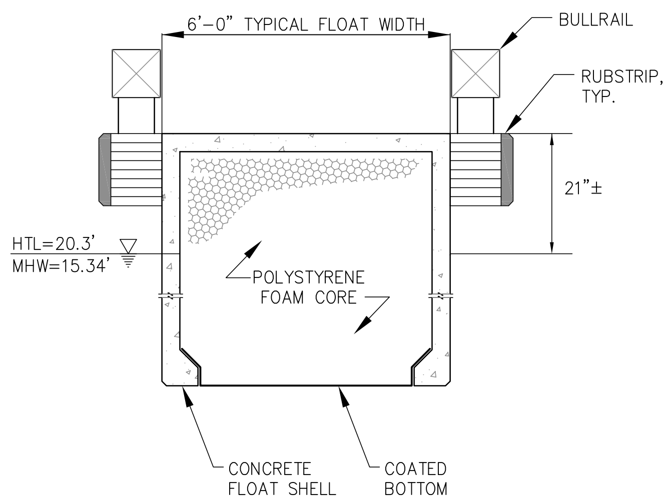


NEW MAINWALK FLOAT SECTION



NEW FINGER FLOAT SECTION

PURPOSE:

THE PROJECT PURPOSE IS TO IMPROVE SAFETY AND REDUCE CONGESTION BY INCREASING HARBOR EFFICIENCY THROUGH INCORPORATION OF IMPROVEMENT PLANS IDENTIFIED IN THE STATTER HARBOR MASTER PLAN.

DATUM:

MLLW = 0.0' HTL = 20.3'

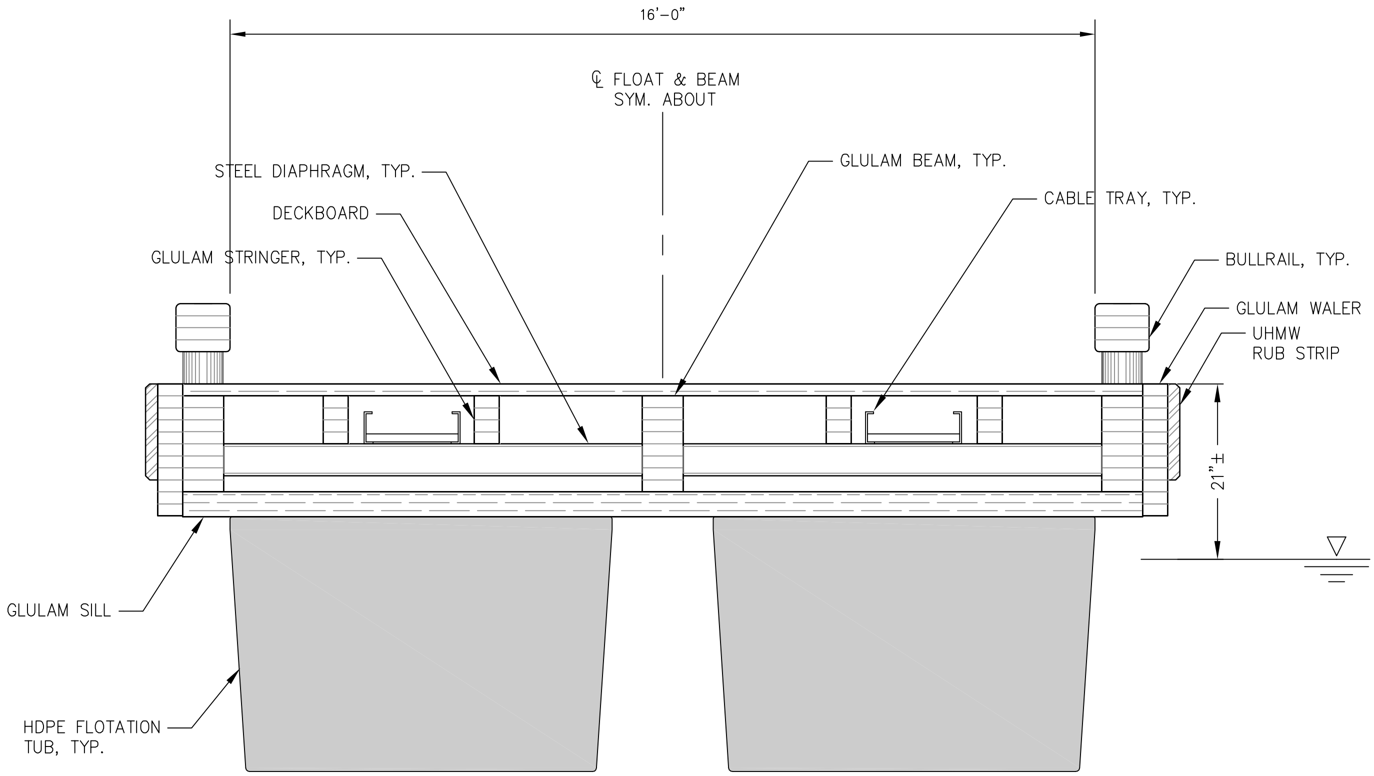
CONCRETE MOORAGE FLOATS TYPICAL SECTION

PND PROJECT NO. 152069

STATTER HARBOR IMPROVEMENTS PHASE III

APPLICANT: CITY AND BOROUGH JUNEAU/ DOCKS AND HARBORS
FILE NO.:
WATERWAY: AUKE BAY
PROPOSED ACTIVITY: HARBOR IMPROVEMENTS
SEC. 23 **T.** 40 S **R.** 65 E **M** COPPER RIVER MERIDIAN
LAT.: 58.3852° N **LONG.:** 134.6461° W
DATE: MAY 2017

SHEET **10** of **13**



TYPICAL SECTION

PURPOSE:

THE PROJECT PURPOSE IS TO IMPROVE SAFETY AND REDUCE CONGESTION BY INCREASING HARBOR EFFICIENCY THROUGH INCORPORATION OF IMPROVEMENT PLANS IDENTIFIED IN THE STATTER HARBOR MASTER PLAN.

DATUM:

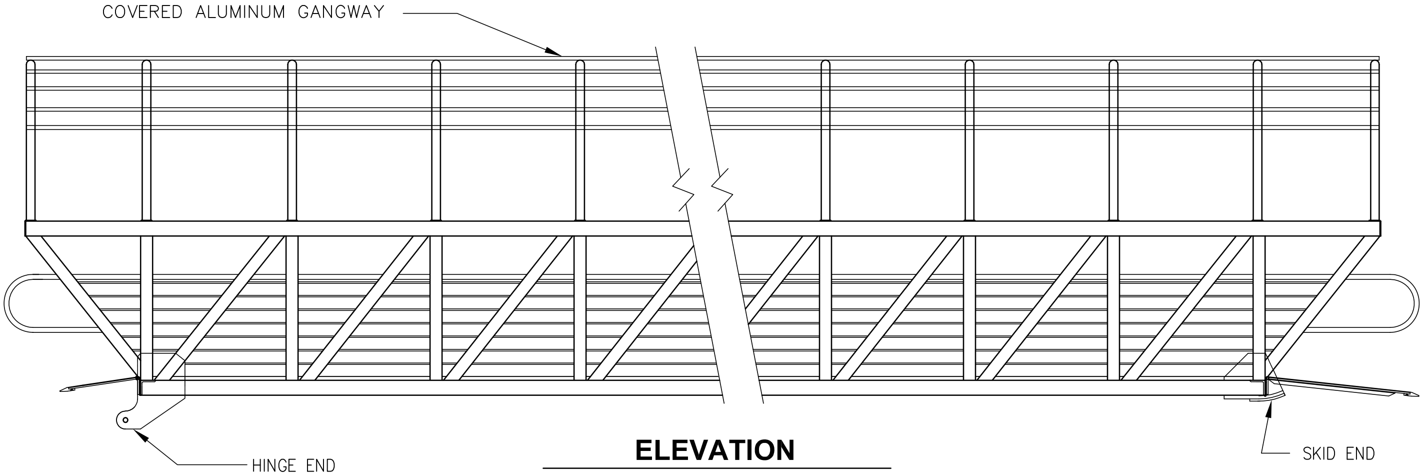
MLLW = 0.0'   HTL = 20.3'

TIMBER MOORAGE FLOATS TYPICAL SECTION

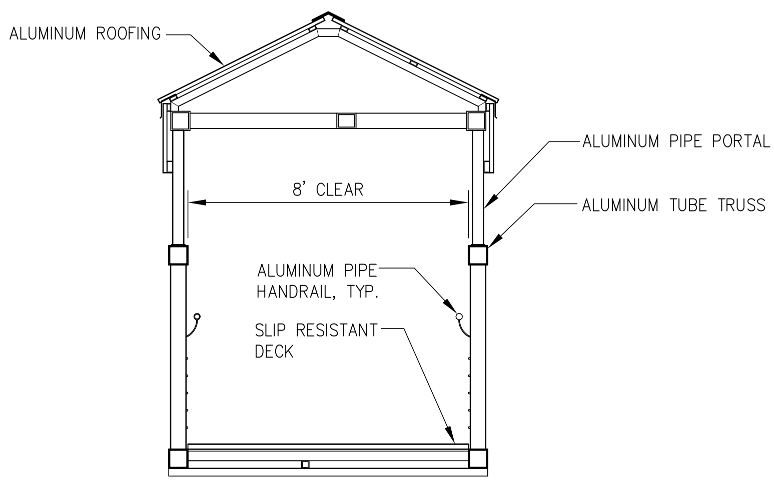
PND PROJECT NO. 152069

STATTER HARBOR IMPROVEMENTS PHASE III

APPLICANT: CITY AND BOROUGH JUNEAU/ DOCKS AND HARBORS
FILE NO.:
WATERWAY: AUKE BAY
PROPOSED ACTIVITY: HARBOR IMPROVEMENTS
SEC. 23 **T.** 40 S **R.** 65 E **M** COPPER RIVER MERIDIAN
LAT.: 58.3852° N   **LONG.:** 134.6461° W
DATE: MAY 2017



ELEVATION



TYPICAL SECTION

PURPOSE:

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DATUM:

MLLW = 0.0' HTL = 20.3'

GANGWAY

PND PROJECT NO. 152069

STATTER HARBOR IMPROVEMENTS PHASE III

APPLICANT: CITY AND BOROUGH JUNEAU/ DOCKS AND HARBORS
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WATERWAY: AUKE BAY
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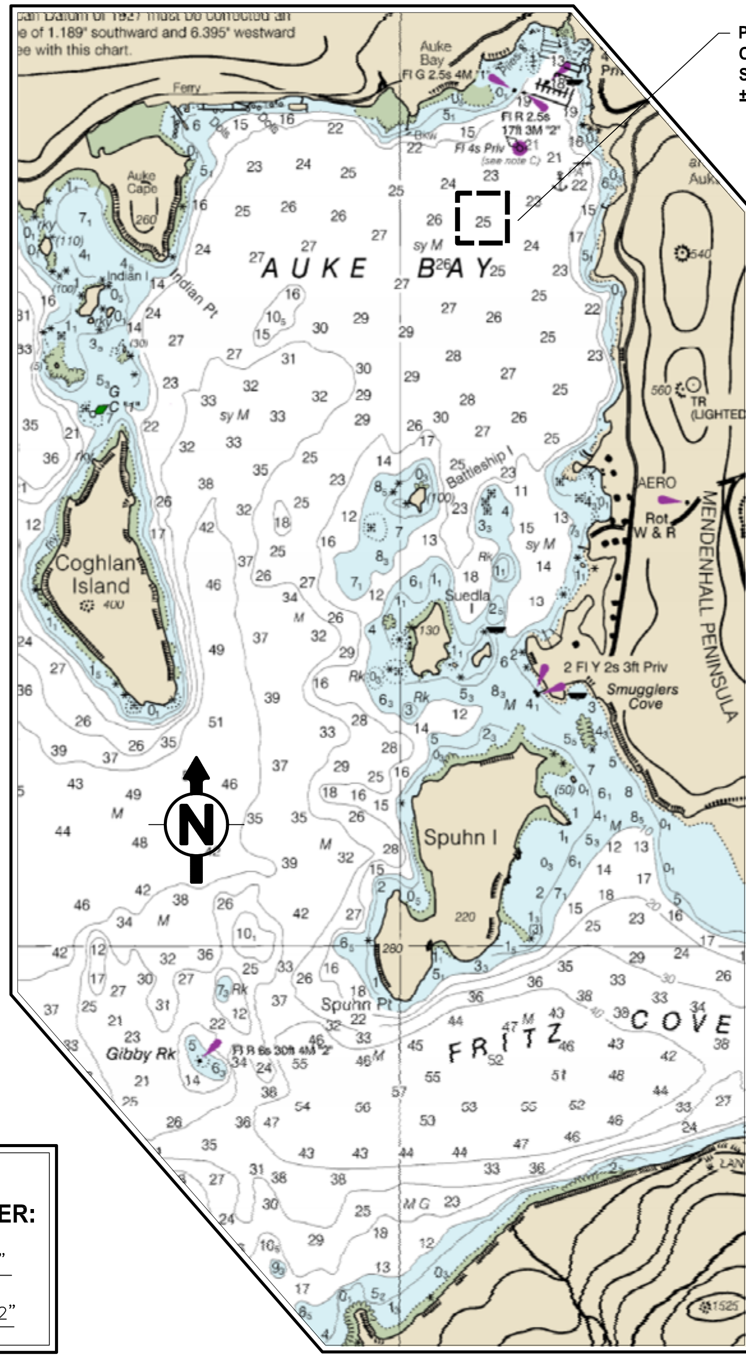

PROPOSED OFFSHORE DISPOSAL SITE CENTER ± 65 ACRES

OFFSHORE DISPOSAL SITE CENTER:

LAT: N 58°22'22.08"

LONG: W 134°39'49.32"

NOTE:
CENTER LOCATION APPROXIMATE

BATHYMETRY FROM: NOAA 17315 GASTINEAU CHANNEL AND TAKU INLET

PURPOSE:

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DATUM:

MLLW = 0.0' HTL = 20.3'

OFFSHORE DISPOSAL SITE

SCALE IN MILES

0 ½ 1

PND PROJECT NO. 152069

STATTER HARBOR IMPROVEMENTS PHASE III

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DATE: MAY 2017

SHEET **13** of **13**

Appendix B. Marine Mammal Monitoring Plan

Marine Mammal Monitoring Plan

for the

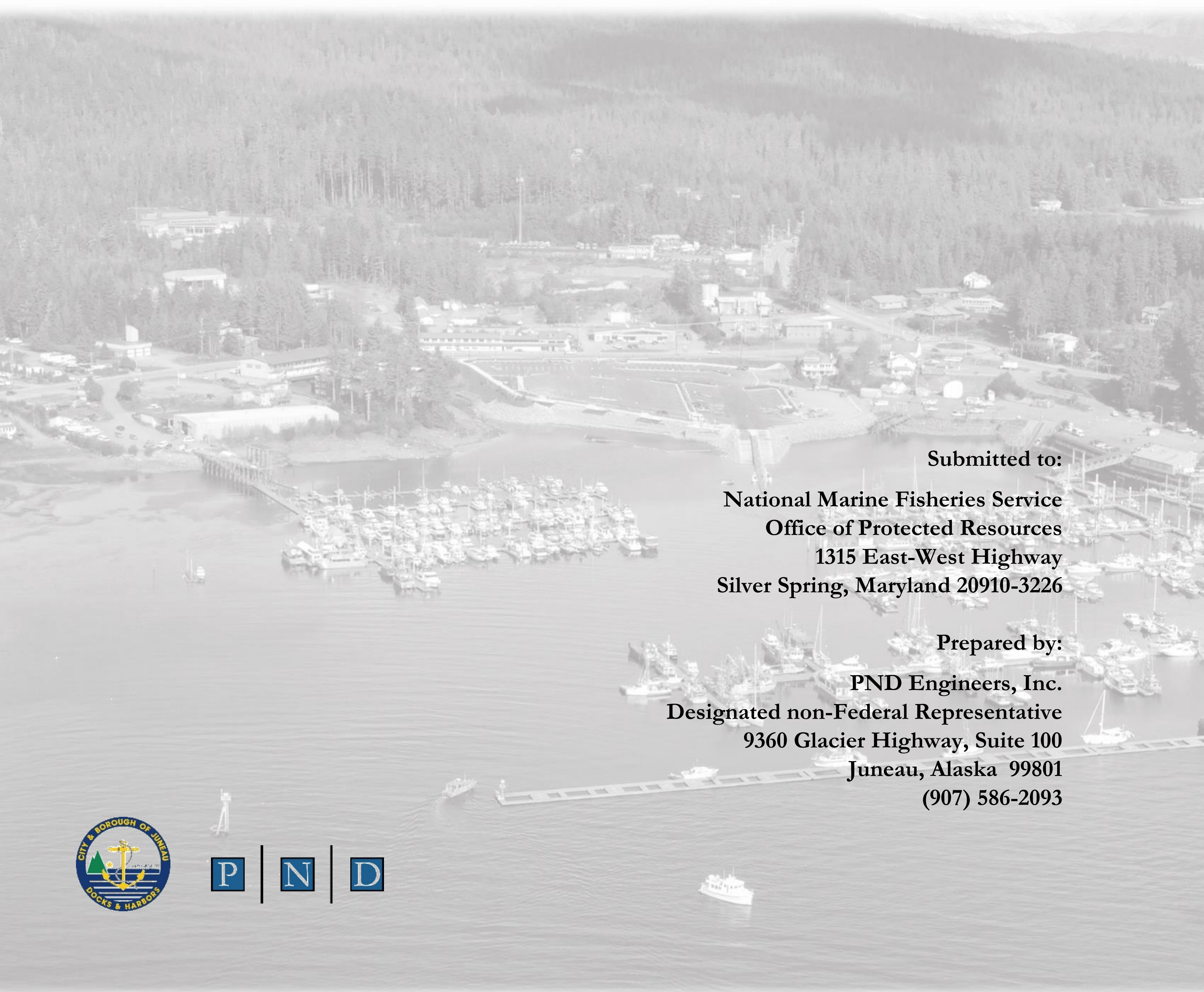
Statter Harbor Improvements Project Phase III A

City and Borough of Juneau, Alaska

Docks and Harbors Department

August 2018

(DRAFT Pending receipt of final permits)



Submitted to:

National Marine Fisheries Service
Office of Protected Resources
1315 East-West Highway
Silver Spring, Maryland 20910-3226

Prepared by:

PND Engineers, Inc.
Designated non-Federal Representative
9360 Glacier Highway, Suite 100
Juneau, Alaska 99801
(907) 586-2093

CITY & BOROUGH OF JUNEAU DOCKS & HARBORS

P N D

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ACRONYMS AND ABBREVIATIONS

- CBJ City and Borough of Juneau
- D&H Docks and Harbors Department
- ESA Endangered Species Act
- GPS global positioning system
- IHA Incidental Harassment Authorization
- MMMP Marine Mammal Monitoring Plan
- MMPA Marine Mammal Protection Act
- MSE Mechanically Stabilized Earth
- NMFS National Marine Fisheries Service
- NOAA National Oceanic and Atmospheric Administration
- PND PND Engineers, Inc.
- PTS permanent threshold shift
- SPL sound pressure level
- TTS temporary threshold shift

1 Introduction

The purpose of this Marine Mammal Monitoring Plan (MMMP) is to provide a protocol for monitoring affected species during the proposed construction of Phase III A of the City and Borough of Juneau Docks and Harbors Department (CBJ D&H) Statter Harbor Improvements Project in Juneau, Alaska. This plan was developed to support the Incidental Harassment Authorization (IHA) application under the Marine Mammal Protection Act, Section 101(a)(5)(D) permitting. The IHA application provides a detailed discussion on the calculations for the proposed action.

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

- To monitor the proposed shutdown and monitoring zones, to estimate the number of marine mammals exposed to noise at, or exceeding established thresholds, and to document animal responses;
- To minimize impacts to the marine mammal species present in the project area by implementing mitigation measures including monitoring, ensuring the shutdown zones are clear of marine mammals, soft start, and shutdown procedures; and
- To collect data on takes, occurrence and behavior of marine mammal species in the project area and any potential impacts from the project.

Figure 1. Project location within Auke Bay, Juneau, AK

2 Phase III A Project Description

CBJ D&H is proposing improvements to Statter Harbor within Auke Bay in Juneau, Alaska to improve safety, increase efficiency and reduce congestion. A complete description of the region, project tasks, project materials, dates and duration, affected species, and anticipated impacts are included in the Phase III A IHA application to which this document is a companion. In general terms, this phase of the project will consist of demolition of the existing dock, dredging of the existing harbor basin, blasting to expand the harbor basin, and construction of a mechanically stabilized (MSE) wall surrounding the new basin.

3 Species Covered Under IHA

Only Steller sea lions (*Eumetopias jubatus*), harbor seals (*Phoca vitulina*) and humpback whales (*Megaptera novaeangliae*) are covered under the Phase III A IHA request.

Work will shut down if any other marine mammal enters an unauthorized harassment zone. This may include, but is not limited to, harbor porpoises (*Phocoena phocoena*), Dall's porpoise (*Phocoenoides dalli*) and killer whales (*Orcinus orca*), which are known to occur in the project area infrequently. California sea lions (*Zalophus californianus)* and Northern fur seals (*Callorhinus ursinus*) have occurred in Auke Bay on an extremely rare basis and are not expected to occur in the vicinity of the project area.

4 Methods

Under directives in the Marine Mammal Protection Act (MMPA) and the Endangered Species Act (ESA), this marine mammal monitoring and impacts minimization plan was tailored to the project to ensure appropriate documentation and compliance with applicable regulations. Monitoring will be conducted by qualified, trained marine mammal observers (hereafter, "observers"). Land-based observers will be located on-site before, during, and after in-water construction activity at sites appropriate for monitoring marine mammals within and approaching the Level A and Level B harassment zones.

During observation periods, observers will continuously scan the area for marine mammals using binoculars and the naked eye. Observers will work shifts of a maximum of four consecutive hours followed by an observer rotation or a 1-hour break and will work no more than 12 hours in any 24-hour period. Observers will collect data including environmental conditions (e.g., sea state, precipitation, glare, etc.), marine mammal sightings (e.g., species, numbers, location, behavior, responses to construction activity, etc.), construction activity at the time of sighting, and number of marine mammal exposures (takes). Observers will conduct observations, meet training requirements, fill out data forms, and report findings in accordance with this MMMP.

Observers will implement mitigation measures including monitoring of the proposed shutdown and monitoring zones, ensuring shutdown zones are clear of marine mammals, and shutdown procedures. They will be in continuous contact with the construction personnel via two-way radio. A cellular phone with local service will be used as back-up communications and for safety purposes.

An employee of the construction contractor will be identified as the monitoring coordinator for observers at the start of each construction day. Observers will report directly to the monitoring coordinator when a shutdown is deemed necessary due to marine mammals approaching the relevant shutdown zones construction activity.

4.1 Observer Qualifications

Monitoring will be conducted by qualified, trained observers. In order for observers to be considered qualified, the following requirements must be met:

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

4.2 Data Collection

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

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

4.3 Equipment

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

- Appropriate Personal Protective Equipment;
- Portable radios and headsets for the observers to communicate with the monitoring coordinator and other observers;
- Cellular phone as backup for radio communication;
- Contact information for the other observers, monitoring coordinator, and NMFS point of contact;
- Daily tide tables for the project area;
- Watch or chronometer;
- Binoculars (quality 7 x 50 or better) or spotting scope with built-in rangefinder or reticles (rangefinder may be provided separately);
- Hand-held GPS unit, map and compass, or grid map to record locations of marine mammals;

- Copies of MMMP, IHA, and/or other relevant permit requirement specifications in sealed clear plastic cover;
- Notebook with pre-standardized monitoring Observation Record forms on waterproof paper; and

4.4 Shutdown and Monitoring Zones

CBJ D&H has established shutdown and monitoring zones to delineate areas in which marine mammals may be exposed to injurious underwater sound levels due to in-water construction. Work which could cause noise levels to rise above non-permitted thresholds will shut down if marine mammals are approaching shutdown zones. Observers will also monitor and document activities in areas where animals could be subjected to noise levels at or above the permitted thresholds. The effective zones are summarized below and are discussed in detail in Section 5 of the IHA request.

Species with permitted Level B harassment under the IHA include humpback whales (*Megaptera novaeangliae*), Steller sea lions (*Eumetopias jubatus*), and harbor seals (*Phoca vitulina*). Take of any other marine mammal is not permitted under the IHA, nor is take by activities not authorized by the IHA.

Determination of harassment radii was discussed fully the IHA request. The effective radii are summarized in Tables 1-3 below. Selection of the appropriate observation radius depends on the concurrent work activities and planned duration. The following shall apply to monitoring and shutdown zones.

- During all in-water or over-water construction activities having the potential to affect marine mammals, a shutdown zone of 10 meters will be monitored to ensure that animals are not endangered by physical interaction with construction equipment. These activities could include, but are not limited to, the positioning of the pile on the substrate via a crane ("stabbing" the pile) or the removal of the pile from the water column/substrate via a crane ("deadpull"), or the slinging of construction materials via crane.
- During dredging, in-water fill placement, dredge disposal, and vibratory pile removal, a shutdown zone shall include the 10-meter minimum zone described above, all areas where the underwater noise levels are anticipated to equal or exceed non-permitted thresholds for permitted species, or where the Level B harassment threshold would be exceeded for a marine mammal not included in the IHA.
- During dredging, in-water fill placement, dredge disposal, and vibratory pile removal, the monitoring zone shall include all areas where the underwater sound pressure levels (SPLs) are anticipated to equal or exceed permitted thresholds for permitted species.
- During blasting, a shutdown zone for non-emplacement shall include all areas where the underwater noise levels are anticipated to equal or exceed permitted thresholds for permitted species or areas where Level B thresholds would be exceeded for a marine mammal not included in the IHA. Following the commencement of emplacement, blasting operations will follow the procedures outlined in Section 4.6.4.
- During dredge disposal, an exclusion zone of 330 feet (100 meters) will be observed. The barge will not approach any marine mammals within this zone, in compliance with the NMFS Marine Mammal Viewing Guidelines and Regulations, to reduce the chance of vessel strikes.
- The harassment zones will be monitored throughout the permitted in-water or over-water construction activity.
    - If a permitted marine mammal enters the monitoring zone, an exposure will be recorded and animal behaviors documented. However, permitted construction activities would continue without cessation unless the animal approaches or enters the shutdown zone.
    - If a marine mammal approaches or enters a shutdown zone, all permitted construction activities will be immediately halted until the marine mammal has left the shutdown zone.

- Take, in the form of Level A or Level B harassment, of marine mammals other than permitted species is not authorized and will be avoided by shutting down construction activities before individuals of these species enter the Level B harassment zone.

Table 1. Effective Shutdown and Monitoring Zones – Underwater Sources

Source	Shutdown Zone – Permitted Species			Monitoring Zone	Shutdown Zone
	Humpback whales	Harbor seals	Steller sea lions	Permitted Species	Non-Permitted Species
Vibratory Pile Removal - Steel	33 ft (10 m)	33 ft (10 m)	33 ft (10 m)	5950 ft (1815 m)	
Vibratory Pile Removal - Timber	33 ft (10 m)	33 ft (10 m)	33 ft (10 m)	8060 ft (2460 m)	
Dredging and In-Water Fill Placement and Removal	33 ft (10 m)	33 ft (10 m)	33 ft (10 m)	355 ft (110 m)	
Dredge Disposal	330 ft (100 m)				

*Since Level A harassment zones are smaller than the conservative 10-meter shutdown zone to prevent physical injury, the conservative shutdown zone will be implemented for all in-water activities.

Table 2. Effective Shutdown and Monitoring Zones – Blasting

Non-Permitted Species	Low Frequency Cetaceans (LF)	Mid-Frequency Cetaceans (MF)	High Frequency Cetaceans (HF)	Phocid Pinnipeds (PW)	Otariid Pinnipeds (OW)
Shutdown Zone – Non-Permitted Species	3560 ft (1085 m)	160 ft (50 m)	3530 ft (1075 m)	1070 ft (330 m)	220 ft[1] (70 m)
Permitted Species	**Humpback whales**	**-**	**-**	**Harbor seals**	**Steller sea lions**
Shutdown Zone – Permitted Species	100 ft (30 m)	-	-	150 ft (45 m)	130 ft (40 m)
Level A Monitoring Zone – Permitted Species	N/A[2]	-	-	220 ft (65 m)	195 ft (60 m)
Level B Monitoring Zone – Permitted Species	3560 ft (1085 m)	-	-	1070 ft (330 m)	220 ft[1] (70 m)

[1] Potential for slight lung injury in California sea lion infants occurs at a distance further than the potential for TTS, so this isopleth will be used for shutdown.
[2] Level A take has not been requested for humpback whales as they are unlikely to be found within the injury isopleth for blasting.

Table 3. Effective Shutdown and Monitoring Zones – Airborne Sources

Airborne Noise			
Source	Shutdown Zone*	Monitoring Zone	
		Harbor seals	Steller sea lions
Vibratory Removal – Steel Pile	33 ft (10 m)	115 ft (35 m)	33 ft (10 m)
Blasting Shaft Drilling	33 ft (10 m)	115 ft (35 m)	33 ft (10 m)

*Since Level A harassment thresholds do not exist for airborne noise, the 10-meter shutdown zone will be implemented for all hauled-out marine mammals.

4.5 Observer Monitoring Locations

In order to monitor the Level A and Level B harassment zones effectively, observers will be positioned at the best practicable vantage points, taking into consideration security, safety, access, and space limitations. Observers will be stationed at locations that provide adequate visual coverage for shutdown and monitoring zones. Potential observation locations are depicted in Figures 2 and 3. For observation zones larger than 500 meters, at least one other additional observer will be placed at the outermost float or other similar vantage point in order to observe the extend observation zone. Optimal observation locations will be selected based on visibility and the type of work occurring.

Monitoring zone identification may be based on fixed points and structure-defined areas incorporating the zone radii or greater area, rather than exact measurements. Marine mammal researchers and monitoring personnel typically use spotting scopes and binoculars to enhance visibility and reticle binoculars and laser range finders to gauge distance of animals from viewing stations. However, Statter Harbor provides challenges for these technologies. Reticle binoculars require an open-water backdrop (open horizon) to determine the angle for calculating distance to an object, and the observer must always know height above the subject viewed to make an accurate distance estimate. The recommended observation stations for this project are high points that provide a greater field-of-view of the project area, but complicate the geometry required for estimating distance to moving animals. Limiting factors such as structures, moving boats, or fog can interfere with spotting scope or laser rangefinder distance measurements. For these reasons, we propose using monitoring zones defined by structures (such as ramps, docks, land features, and pilings) of precisely known geographic locations that approximately correspond to the calculated perimeters from circular project site monitoring zones. This practical adaptation will provide for much more precise counting of animals in a particular section of Auke Bay without introducing ambiguous estimates of distance from construction equipment.

4.5.1 Pile Removal and Blasting

During pile removal and blasting, the primary observer stations are the Statter Harbor Shelter (located near the new launch ramp) and at the Auke Bay Marine Station (Figure 2). Other stations (Figure 3) will be utilized as needed when the view is blocked by construction equipment, staged materials, vessels, fog, or other obstructions or to ensure observer safety. Additional alternative monitoring locations include the Statter Harbormaster's walkway and the end of the new launch ramp.

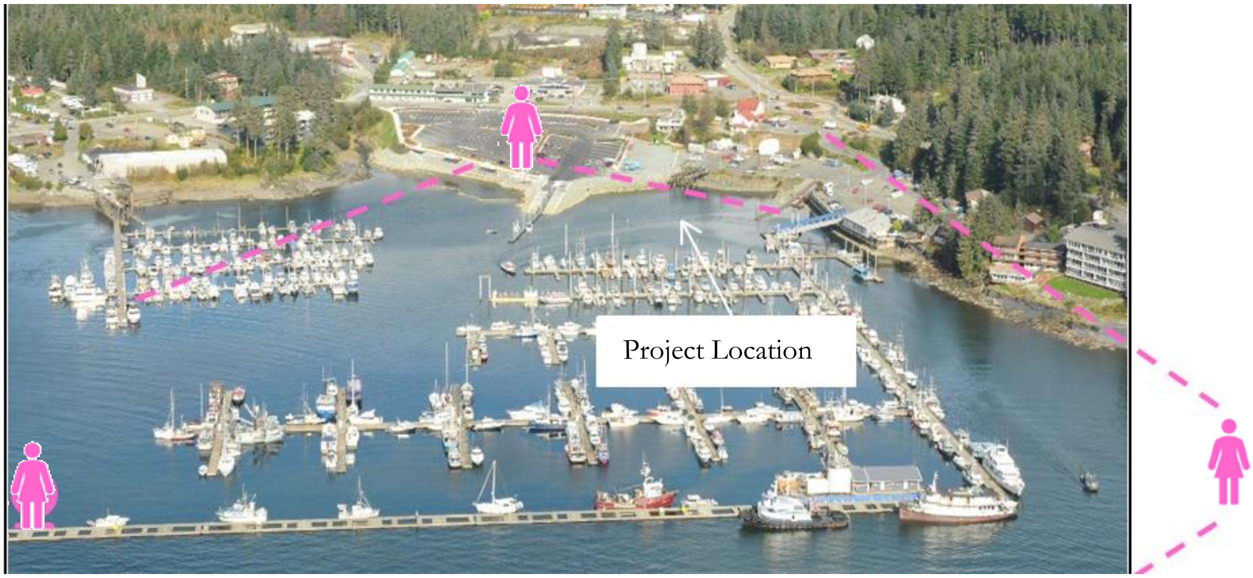

Figure 2. Potential Observer Locations

Figure 3. Alternate Observer Locations

4.5.2 Dredging and Dredge Disposal

During dredging, a single observer will be located on the Harbormaster's walkway and, if needed, an additional observer either at the end of the new Statter Harbor Launch Ramp or the Statter Harbor Shelter. One observer should be sufficient to overserve this small zone, but a second station will be added if construction equipment impedes visibility.

Since no takes are being requested for dredge disposal and considering safety concerns and limited space on the tugboats, tug operators will be trained to observe during disposal events. This will ensure no marine mammals are approached within 100 meters and that the zone is clear before disposal, without requiring an additional observer in tight quarters.

4.6 Monitoring Techniques

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

Monitoring of shutdown and observation zones will take place from 30 minutes prior to initiation through 30 minutes post-completion of all permitted activities. To augment observer viewing and documentation for species identification and quantification, one of the observers will also monitor streaming camera views of the broader project action area.

Observation generally necessitates that daylight is sufficient for observers to visualize the entirety of the monitoring zones, so observations will commence and complete during daylight hours to the extent possible. However, daylight hours are limited during winters in Alaska and there is a chance the contractor may need to work outside of daylight hours, particularly in November through February. During Phase III A, some dredging and dredge disposal may need to occur outside of daylight hours. As the monitoring zones associated with this activity are relatively small, additional lighting will be utilized as necessary to ensure the exclusion zones are fully visible.

4.6.1 Pre-Activity Monitoring

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

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

4.6.2 Soft Start Procedures

Soft start procedures will be used prior to periods of vibratory driving, dredging, and in-water fill placement to allow marine mammals to leave the area prior to exposure to maximum noise levels.

- For vibratory hammers, the contractor shall run the vibratory hammer for no more than 30 seconds followed by a quiet period of at least 60 seconds without vibratory removal of piles. The process shall be repeated twice more within 10 minutes before beginning vibratory removal operations that last longer than 30 seconds.
- For other heavy equipment operating from barges or nearshore, the equipment will be idled for 15 minutes prior to operation.
- If work ceases for more than 30 minutes, soft start procedures must recommence prior to performing additional work.

4.6.3 During-Activity Monitoring

The following monitoring methodology will be implemented during permitted activities:

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

4.6.4 Inclement weather

During inclement weather or periods of limited visibility, work that has begun with a fully cleared observation zone may continue. In those cases, an assumed rate of observation similar to the daily average rate of observation will be used to estimate the number of sightings to be reported during those periods. This method will only be used if the full observation zone was visible during the start of work and no shutdowns greater than 30 minutes have occurred.

4.6.5 Blasting

The explosives cannot "sleep" for longer than 24 hours without becoming a risk to private property and human health, and they cannot be detonated in the dark.

Observations will begin 30 minutes prior to blasting activities. Charges will not be emplaced if marine mammals are present within a shutdown zone or the injury monitoring zone for permitted species for or if a protected species seems likely to enter one of these zones. If permitted species enter the blast injury area following the commencement of emplacement, detonation will be delayed as long as possible.

All other legal measures to avoid injury will be utilized; however, the blast will be detonated when delay is no longer feasible.

4.6.6 Shutdown

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

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

- Observers will then radio or call the monitoring coordinator that activities can re-commence.

4.6.7 Breaks in Work

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

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

4.6.8 Post-Activity Monitoring

Monitoring of the shutdown and monitoring zones will continue for 30 minutes following completion of vibratory pile-removal, blasting, dredging, dredge disposal, or in-water fill placement or removal activities. A post-monitoring period is not required for other in-water construction. These surveys will record observations, focusing on observing and reporting unusual or abnormal behavior of marine mammals. Observation Record forms will be used to document observed behavior.

5 Reporting

5.1 Injured or Dead Marine Mammal

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

- If the marine mammal's condition is a direct result of the project, notification will be made and work will stop until NMFS is able to review the circumstances of the prohibited take.
- If the lead observer determines that the injury or death is not associated with or related to the activities authorized in the IHA (e.g., previously wounded animal, carcass with moderate to advanced decomposition, scavenger damage), CBJ D&H shall report the incident within 24 hours of the discovery. Construction activities may continue while NMFS reviews the circumstances of the incident and makes a final determination on the cause of the reported injury or death.
- If cause of death is unclear, CBJ D&H shall immediately report the incident. Construction activities may continue while NMFS reviews the circumstances of the incident and makes a final determination on the cause of the reported injury or death. NMFS will work with CBJ D&H to determine whether additional mitigation measures or modifications to the activities are appropriate.

Care should be taken in handling dead specimens, if encountered, to preserve biological materials in the best possible state for later analysis of cause of death. In preservation of biological materials from a dead animal, the finder (i.e. observer) has the responsibility to ensure that evidence associated with the specimen is not unnecessarily disturbed.

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

5.2 Annual Report

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

At a minimum the reports shall include:

- 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 removal being conducted (pile locations, pile size and type), and times (onset and completion) when pile removal occurs.
  - The construction contractor and/or marine mammal monitoring staff will coordinate to ensure that vibratory pile removal times and strike counts are accurately recorded. The duration of soft start procedures should be noted as separate from the full power duration.
  - Description of in-water construction activity not involving pile driving (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 in-water construction is delayed due to presence of marine mammals within shutdown zones.
- During-activity observational survey-specific data:
  - Description of any observable marine mammal behavior within monitoring zones or in the immediate area surrounding the monitoring zones, including the following:
    - Distance from animal to vibratory pile removal sound source.
    - Reason why/why not shutdown implemented.
    - If a shutdown was implemented, behavioral reactions noted and if they occurred before or after implementation of the shutdown.
    - If a shutdown was implemented, the distance from animal to sound source at the time of the shutdown.
    - Behavioral reactions noted during soft starts and if they occurred before or after implementation of the soft start.
    - Distance to the animal from the sound source during soft start.
- Post-activity observational survey-specific data:
  - Results, which include the detections and behavioral reactions of marine mammals, the species and numbers observed, sighting rates and distances,

- Refined exposure estimate based on the number of marine mammals observed. This may be reported as a rate of take (number of marine mammals per hour or per day), or using some other appropriate metric.

Appendix A. Marine Mammal Observation Record

MARINE MAMMAL OBSERVATION RECORD

Project Name: Statter Harbor Improvements
Monitoring Location: ______
Date: ______
Time Effort Initiated: ______
Time Effort Completed: ______
Page ___ of ___

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

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

Marine Mammal Observation Record – Sighting Codes

Behavior Codes

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

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

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

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

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

Event

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

Sighting Cues

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

Marine Mammal Species

Code	Marine Mammal Species
HSEA	Harbor Seal
STSL	Steller Sea Lion
HPBK	Humpback Whale
OTT	Sea Otter
STEID	Steller's Eider
OTHR	Other

Construction Type

Code	Activity Type
V	Vibratory Pile Driving (installation and extraction)
I	Impact Pile Driving
DP	Dead pull
ST	Stabbing
DR	Drilling
OWC	Over-Water Construction
NOWC	No Over-Water Construction
NONE	No Construction

Mitigation Codes

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

Visibility

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

Weather Conditions

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

Wave Height

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

Appendix C. General Blast Plan and Analysis

General Blast Plan and Analysis

Project: Statter Harbor Improvements Phase III
Project No: CBJ Project DH08-081, PND 152069.06
Submitted to: PND Engineers
Description of work: General underwater blast plan and underwater overpressure predictions

SUMMARY

Plans for Statter Harbor Improvements include deepening a portion of the harbor to accommodate a new float arrangement. This brief plan provides a general approach to underwater rock blasting for excavation as part of Phase III Statter Harbor Improvements. Excavation may include blasting less than 2,000 cubic yards (CY) of submerged rock. All materials presented in this report should be considered as preliminary information to be used for permitting purposes. The conceptual design presented is based on industry practice, proven methods, and experience and is believed to be accurate and up-to-date. The information may be used as a guide during project planning. However final blast designs will depend on site factors that cannot be determined until work begins. Only the blaster-in-charge can supply a final design once drilling begins and actual rock conditions are determined.

The scope of work in this report includes

- General approach and blast plan for underwater blasting in Statter Harbor
- Underwater blast pressure predictions

SITE DESCRIPTION

Proposed dredge limits for the new charter float area are -16 ft below mean lower low water (MLLW = 0 ft) with a 1 ft overdepth (-17 ft). Bedrock within the proposed dredge limits is outlined in Figure 1. Geotechnical exploration performed by PND Engineers included borehole samples and test probing for depth. Bedrock was encountered in boreholes BH-2B and PND-10 and consisted of a metamorphic rock of mudstone origin. The rock is classified as a medium hard to hard thinly bedded slaty argillite dipping steeply northeast. Overburden is a sandy silt. Test probing indicated that top-of-rock elevations range from approximately -4 ft below MLLW to below overdepth dredge elevations (-17 ft). Rock volume to be blasted includes subdrill (5 ft) and is estimated to be 3,298 CY. Estimated rock excavation volume to overdepth -17 ft is 1,761 CY. Overburden materials will be removed prior to drilling to obtain accurate top of rock elevations and additional rock quality information.

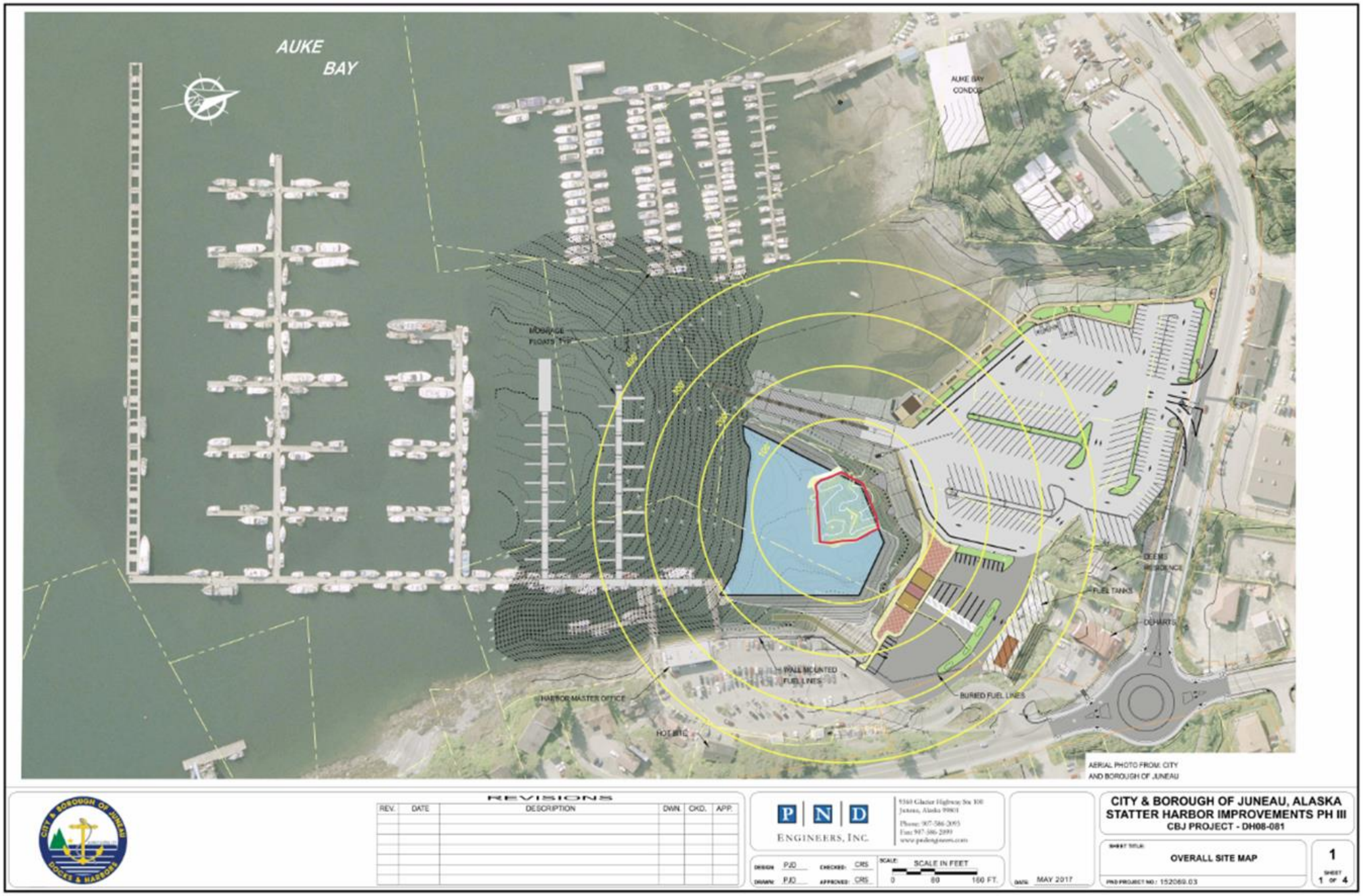

Figure 1. Overall site map of Statter Harbor. Proposed dredge area shown in blue and bedrock outline in red.

GENERAL DRILL & BLAST DESIGN CONSIDERATIONS

Preliminary blast designs are necessary to determine drill and blast methods and to determine potential impacts of selected methods. A typical section view with elevations and boreholes are shown in Figure 2 with a typical loading diagram. Potential blast designs are based on the following considerations.

- Powder factor: a driving factor for blast design is the energy required to adequately break the rock. Powder factor is the ratio of explosive energy per cubic yard based on borehole spacing and depth required for production. Powder factors for underwater blasting typically range from 1.5 to 3 lb/CY depending on rock properties and site considerations such as confinement. If confinement is excessive, powder factors may need to be as high as 4 lb/CY.
- Subdrill: the additional borehole length drilled below grade or overdepth to ensure rock breakage to -17 ft below MLLW. Recommend 4 to 5 ft of subdrill to prevent high areas of rock between boreholes.
- Bench height: based on profile information, depths range 4 to 12 ft.
- Hole depth based on bench height and subdrill, ranges between 9 and 17 ft.
- Hole diameter: diameter of drilled holes is assumed to be 3.5 to 4.5 inches.
- Pattern: burden and spacing dimensions are recommended to be between 7 and 10 feet to achieve the necessary breakage. Borehole pattern and stemming lengths can be adjusted to obtain appropriate powder factors.
- Stemming: material used to confine energy in blast hole should consist of 3/8-inch angular crushed stone. Stemming lengths can be adjusted depending on overburden material and amount of water present during blasting.
- Explosive type: explosive products must have excellent water resistance and must also resist dynamic pre-compression. Dynamite or booster sensitive emulsions are recommended.
- Detonation timing: It is recommended to use a dual initiator non-electric detonation system
- Other considerations include tidal fluctuations, seasonal weather conditions, environmental concerns and timing windows, qualifications of the contractor and crew, method of drilling and loading, and the number of blasts necessary to remove bedrock above the design dredge elevation.

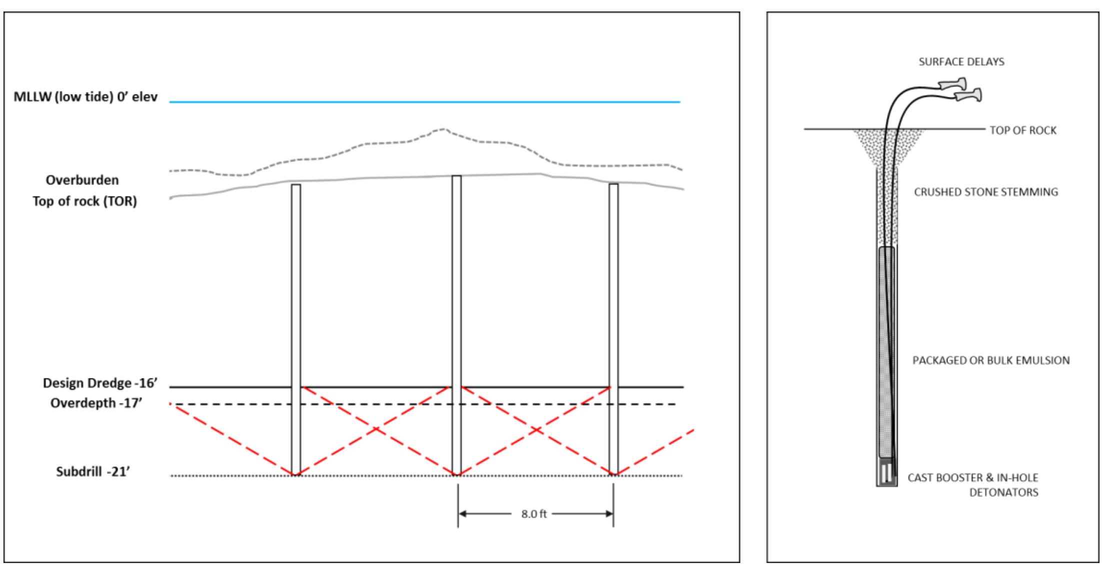

Figure 2. Typical section view and loading profile

UNDERWATER OVERPRESSURE ANALYSIS

Blasting in or adjacent to waterbodies has the potential to create near instantaneous pressure increases and decreases that may impact marine mammals in the area. Table 1 shows criteria used to assess impacts to marine mammals from blasting.

Table 1. Marine mammal injury and disturbance thresholds from *Finneran & Jenkins 2012, **NOAA Technical Memorandum NMFS-OPR-55 July 2016, ***NOAA Optional User Spreadsheet July 2018

Common Name (Hearing Group)	*Birth Mass (kg)	Water Depth (m)	*Mor-tality	*Slight Lung Injury	*GI Tract Injury	**PTS		**TTS		*** Behavior
			I_M *Pa·s*	I_S *Pa·s*	SPL_{PK} *dB re 1 μPa·s*	SEL *dB re 1 μPa²·s*	SPL_{PK} *dB re 1 μPa·s*	SEL *dB re 1 μPa²·s*	SPL_{PK} *dB re 1 μPa·s*	SPL_{PK} *dB re 1 μPa·s*
humpback whale (LF)	680	10	1133.8	485.0	237	183	219	168	213	163
orca (MF)	160	10	700.0	299.4	237	185	230	170	224	165
Dall's porpoise (HF)	6	10	234.3	100.2	237	155	202	140	196	135
harbor porpoise (HF)	5	10	220.5	94.3	237	155	202	140	196	135
Steller sea lion (OW)	16	10	324.9	139.0	237	203	232	188	226	183
California sea lion (OW)	6	10	234.3	100.2	237	203	232	188	226	183
northern fur seal (PW)	4	10	204.7	87.6	237	185	218	170	212	165
harbor seal (PW)	7	10	246.7	105.5	237	182	218	170	212	165

Thresholds shown in Table 1 are given as three separate measures of underwater blast overpressures including peak sound pressure level (SPL_{PK} in dB re 1 μPa), impulse (I in Pa·s), and sound exposure level (SEL re 1 μPa^2-s). Blast induced overpressures are affected by many variables including, but not limited to, site conditions (water depth, temperature, current, etc.), rock qualities (type, features, discontinuities, overburden, etc.), and blast design (product type, maximum lb/delay, timing sequence, confinement, etc.). Due to the complex nature and extreme variability in underwater blasting, there are no known prediction formulas that can accurately predict the metrics listed above for all conditions.

Peak overpressure (P_{PK}) is defined as the highest absolute peak measured relative to the ambient pressure. Pressure intensities (measured as psi or Pa) decay with distance from source energy and can be correlated with the following scaled relationship:

$$Cube\ Root\ Scaled\ Distance, CRSD = \frac{D}{W^{1/3}} \quad (1)$$

where D is the distance between the measurement location and the closest blast hole and w is the maximum explosives weight detonated per 8 ms delay period (Cole 1948). Planned charge weights for this project are 93.5 lb/delay or less. The attenuation of peak overpressure for blasting is traditionally described by the power curve function equation

$$P_{PK} = a * CRSD^{-b} \quad (2)$$

where P_{PK} is given in lb/in^2 (psi) and *a* and *b* are site specific fitting parameters. The "a-factor" is influenced by explosive confinement, properties of rock being blasted, type of explosives used, and the depth of the water column overlying the rock surface. The slope term, "-b" expresses the rate of attenuation or decrease of peak pressure with distance and is a constant for marine and lake environments and can vary with flow rate and direction. Commercially available pressure sensors and hydrophones designed specifically for blasting have allowed measurement of blast induced overpressures and development of site-specific attenuation models for many blasting projects. Therefore, the range of fitting parameters "a" and "-b" are well established for the typical range of rock blasting conditions encountered.

Pressure measurements recorded during a large-scale blasting project were selected and analyzed to predict distances where blast induced overpressures will attenuate to the appropriate threshold levels. A similar analog project was selected to replicate the total time-delayed charges, the delay timing in milliseconds that influences the summation of individual pulses into the water column, and the explosive energy of each charge. For this analog project, underwater overpressures were recorded at sample rates up to 500,000 sample/s for more than 100 blasts at two distances from the blasts. Peak pressure and impulse were analyzed and reported throughout the analog blasting project.

Data were fit with a site-specific attenuation model to predict peak pressure, P_{PK}, as a function of CRSD for well- and poorly-confined blasts (Kolden and Aimone-Martin 2014). The attenuation model for well-confined blasts is given as

$$P_{PK} = 928\, CRSD^{-1.04} \quad (3)$$

where P_{PK} is given in lb/in^2 (psi) and This attenuation model is used for the Statter Harbor project. It is important to note that, while the blasts used for analysis were described as confined, proposed blasting in Statter Harbor will occur beneath emplaced fill and will likely have a higher confinement level. Scaled distance attenuation models developed during many underwater blasting projects and conditions suggest that blasts with higher confinement produce lower peak overpressures at given distances. Therefore, this model is likely a conservative representation of what can be anticipated at Statter Harbor.

There are no guidelines for computing impulse for multi-hole, time delayed underwater blasting, and permitting agencies agreed that the maximum impulse for each blast would be computed as the area under the half-wave containing the peak pressure bounded by zero-crossings for either a positive or negative peak. Both peak pressure (psi) and impulse (I, psi·s) in terms of psi were converted to decibel units and peak pressure is reported as sound pressure level, SPL, in decibels

$$SPL_{PK} = 20\ log_{10}\ \frac{P_{PK}}{P_{ref}} \quad (4)$$

where the reference pressure for water is 1 micro-Pascal (re 1 μPa). While no relationship was discovered between CRSD and impulse, a correlation between positive peak pressure and impulse was found. A line was fit to data from the analog blast project;

$$P_{PK} = 372.65\ (I) + 11.252 \quad (5)$$

where P_{PK} is positive peak pressure given in lb/in^2 (psi) and I is impulse in psi·s. This relationship was used in conjunction with Equations 1 and 3 to predict the distance to the appropriate impulse thresholds. The correlation (R^2) coefficient of 0.24 is relatively low, but reflects the fact that several higher outliers were included, resulting in a more conservative model.

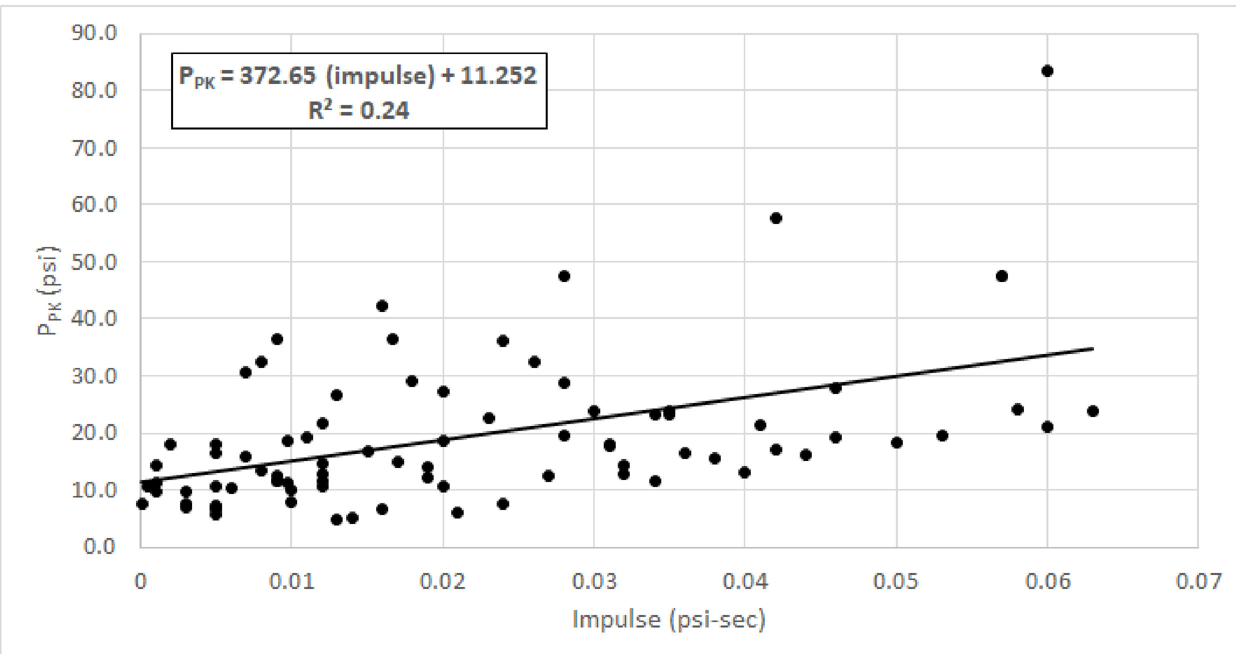

Figure 3. Positive peak pressure vs. impulse relationship

Pressure measurements from several highly confined blasts from the analog project were selected for post processing to establish a method to compute SEL for multi-hole, time delayed blasting of a finite time duration correlated with SPL_{pk}. Selected blasts and overpressure data are summarized in Table 2.

Table 2. Summary of selected blast and overpressure parameters

shot	max lbs/delay	Meas. Dist (ft)	CRSD	Peak Pressure (P_{PK})	Peak Sound Pressure Level (SPL_{PK})	Impulse (I)		Sound Exposure Level (SEL)	
	lbs	ft	ft/lbs$^{(1/3)}$	psi	dB re 1 µPa	psi	dB re 1 µPa·s	psi^2·s	dB re 1µPa^2·s
P39	87	142	32.0	8.3	215.1	0.012	158.4	1.252	197.7
P39	87	284	64.1	7.2	213.9	0.019	162.3	1.147	197.4
P54	60	142	36.3	41.5	229.1	0.04	168.8	23.826	210.5
P54	60	255	65.1	11.7	218.1	0.018	161.9	5.551	204.2
P61	85	139	31.6	21.1	223.2	0.026	165.1	6.441	204.9
P61	85	278	63.2	9.1	216.0	0.015	160.3	2.041	199.9
P66	87	142	32.0	18.4	222.1	0.02	162.8	2.936	201.4
P66	87	274	61.8	8.7	215.5	0.014	159.7	1.665	199.0
P71	87	143	32.3	15.6	220.6	0.054	171.4	4.44	203.2
P71	87	255	57.5	12.9	219.0	0.035	167.7	1.991	199.8

For the purpose of this analysis, equation (6) was used to compute SEL_{CUM}.

$$SEL_{CUM} = 10\ log_{10}\left(\frac{\sum_{n=1}^{N}\int_0^T P_n(t)^2 dt}{P_{ref}^2}\right) \text{ dB re 1 } \mu\text{Pa}^2\cdot\text{s} \qquad (6)$$

where T is the total time of the blast induced pressure time history measured in the water. The analog blasting project was used to predict anticipated source levels (SEL_{CUM}) for the Statter Harbor project (see the Statter Harbor Phase III A IHA Application for details).

Estimated distances to thresholds computed using impulse and peak sound pressure levels are shown in Table 3 below. Distances were calculated using data collected during underwater blasting and the relationships described above. The distances shown in Table 3 are likely a conservative estimate of what can be expected during proposed blasting in Statter Harbor.

Table 3. Estimated distances where peak threshold levels will occur.

Common Name (Hearing Group)	Mortality Isopleth (m)	Slight Lung Injury Isopleth (m)	GI Tract Injury Isopleth (m)	PTS Isopleth (m)	TTS Isopleth (m)
	Peak	Peak	Peak	Peak	Peak
humpback whale (LF)	16.0	30.3	11.5	84.3	163.7
orca (MF)	23.4	40.9	11.5	24.9	48.4
Dall's porpoise (HF)	46.6	66.0	11.5	553.3	1075.0
harbor porpoise (HF)	48.1	67.2	11.5	553.3	1075.0
Steller sea lion (OW)	39.0	58.9	11.5	20.0	38.8

Common Name (Hearing Group)	Mortality Isopleth (m)	Slight Lung Injury Isopleth (m)	GI Tract Injury Isopleth (m)	PTS Isopleth (m)	TTS Isopleth (m)
	Peak	Peak	Peak	Peak	Peak
California sea lion (OW)	46.6	66.0	11.5	20.0	38.8
northern fur seal (PW)	49.8	68.7	11.5	94.1	182.9
harbor seal (PW)	45.4	64.9	11.5	94.1	182.9

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