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DEPARTMENT OF COMMERCE

National Oceanic and Atmospheric Administration

RIN 0648-XR009

Taking of Marine Mammals Incidental to Specific Activities; Taking of Marine Mammals Incidental to Pile Driving Activities during Construction of a Ferry Terminal at Seaplane Lagoon, Alameda Point, San Francisco, California.

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

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

SUMMARY: NMFS has received a request from the City of Alameda (City) for authorization to take marine mammals incidental to pile driving activities during construction of a ferry terminal at Seaplane Lagoon, Alameda Point, San Francisco, California. Pursuant to the Marine Mammal Protection Act (MMPA), NMFS is requesting comments on its proposal to issue an incidental harassment authorization (IHA) to incidentally take marine mammals during the specified activities. NMFS is also requesting comments on a possible one-year renewal that could be issued under certain circumstances and if all requirements are met, as described in *Request for Public Comments* at the end of this notice. NMFS will consider public comments prior to making any final decision on the issuance of the requested MMPA authorizations and agency responses will be summarized in the final notice of our decision.

DATES: Comments and information must be received no later than **[INSERT DATE 30 DAYS AFTER DATE OF PUBLICATION IN THE FEDERAL REGISTER]**.

ADDRESSES: Comments should be addressed to Jolie Harrison, Chief, Permits and Conservation Division, Office of Protected Resources, National Marine Fisheries Service. Physical comments should be sent to 1315 East-West Highway, Silver Spring, MD 20910 and electronic comments should be sent to *ITP.Egger@noaa.gov*.

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

FOR FURTHER INFORMATION CONTACT: Stephanie Egger, Office of Protected Resources, NMFS, (301) 427-8401. Electronic copies of the application and supporting documents, as well as a list of the references cited in this document, may be obtained online at: *https://www.fisheries.noaa.gov/permit/incidental-take-authorizations-under-marine-mammal-protection-act*. In case of problems accessing these documents, please call the contact listed above.

SUPPLEMENTARY INFORMATION:

Background

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

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

National Environmental Policy Act

To comply with the National Environmental Policy Act of 1969 (NEPA; 42 U.S.C. 4321 *et seq*.) and NOAA Administrative Order (NAO) 216-6A, NMFS must review our proposed action (*i.e.*, the issuance of an incidental harassment authorization) with respect to potential impacts on the human environment. This action is consistent with categories of activities identified in Categorical Exclusion B4 (incidental harassment authorizations with no anticipated serious injury or mortality) of the Companion Manual for NOAA Administrative Order 216-6A, which do not individually or cumulatively have the potential for significant impacts on the quality of the human environment and for which we have not identified any extraordinary circumstances that would preclude this categorical exclusion. Accordingly, NMFS has preliminarily determined that the issuance of the proposed IHA qualifies to be categorically excluded from further NEPA review.

We will review all comments submitted in response to this notice prior to concluding our NEPA process or making a final decision on the IHA request.

Summary of Request

On February 22, 2019, NMFS received a request from the City for an IHA to take marine mammals incidental to pile driving activities during construction of a ferry terminal in Seaplane Lagoon, Alameda, California. The application was deemed adequate and complete on June 28, 2019. The applicant's request is for take seven species of marine mammals by Level B harassment only. Neither the City nor NMFS expects serious injury or mortality to result from this activity and, therefore, an IHA is appropriate.

Description of Proposed Activity

Overview

The purpose of this project is to provide facilities to expand the existing ferry service from Alameda and Oakland to San Francisco in order to address the limited capacity at the existing Main Street Ferry Terminal, accommodate the anticipated increase in demand for ferry service from Alameda to San Francisco due to planned development of the Alameda Point Project, and to provide enhanced emergency response services to Alameda in the event of transbay service disruptions.

Currently, the nearest operational ferry terminal to Alameda Point is the Alameda Main Street Terminal along the Oakland Alameda Estuary. There is also a ferry terminal that serves Oakland's Jack London Square. Both of these terminals are owned and operated by the San

Francisco Bay Area Water Emergency Transportation Authority (WETA). Peak time ferry service demand is at capacity. It is not unusual for passengers to be left behind at Alameda during the morning commutes, and parking demand at the facility currently outstrips available spaces. Ferry ridership at the Alameda Main Street WETA terminal is currently at 94 percent capacity and rose 12 percent in the last calendar year. WETA and the City intend to establish a commute-oriented ferry service between Seaplane Lagoon and San Francisco once operating funds and terminal and vessel assets are secured to operate the expansion service.

The Project encompasses both landside and waterside components; however, the in-water work components are discussed in this document. Please refer to the application for more information on landside components.

The in-water sound from the pile driving and removal activities, may incidentally take seven species of marine mammals by Level B harassment only.

Dates and Duration

Project construction is proposed to begin in during early August 2019 and will be completed within approximately one year of initiation. All of the in-water work (float installation with piles and gangway) is expected to be completed within one environmental work season (August 1 to November 30). Construction will occur during weekdays and on weekends if needed. Site preparation and ground improvements will occur over one month, and could overlap with in-water work. Construction of landside improvements will require approximately 4 to 6 months. Approximately 24 total days of pile driving activities are estimated to occur, with 12 days of vibratory hammering installation and removal for template piles, 6 days of vibratory hammering for permanent piles, and 6 days of impact hammering for permanent piles. These are discussed in further detail below.

Specific Geographic Region

Seaplane Lagoon is located at the western end of Alameda Island within the 150-acre Waterfront Town Center area of Alameda Point and on the former Alameda Point Naval Air Station in Alameda, California. The project area is located along the eastern shoreline of Seaplane Lagoon, west of Ferry Point, south of West Atlantic Avenue, and north of West Oriskany Avenue (Figure 1).

Seaplane Lagoon is a rectangular basin approximately 3,000 feet (ft) by 1,600 ft. Breakwaters protect the basin from wind-generated waves, providing typically calm conditions. Seaplane Lagoon is bordered by an existing concrete and steel sheet pile bulkhead to the north, rock slope revetments to the east and west, and a breakwater with a 600-ft opening to the south. The proposed location of the ferry terminal is on the eastern shoreline of the lagoon.

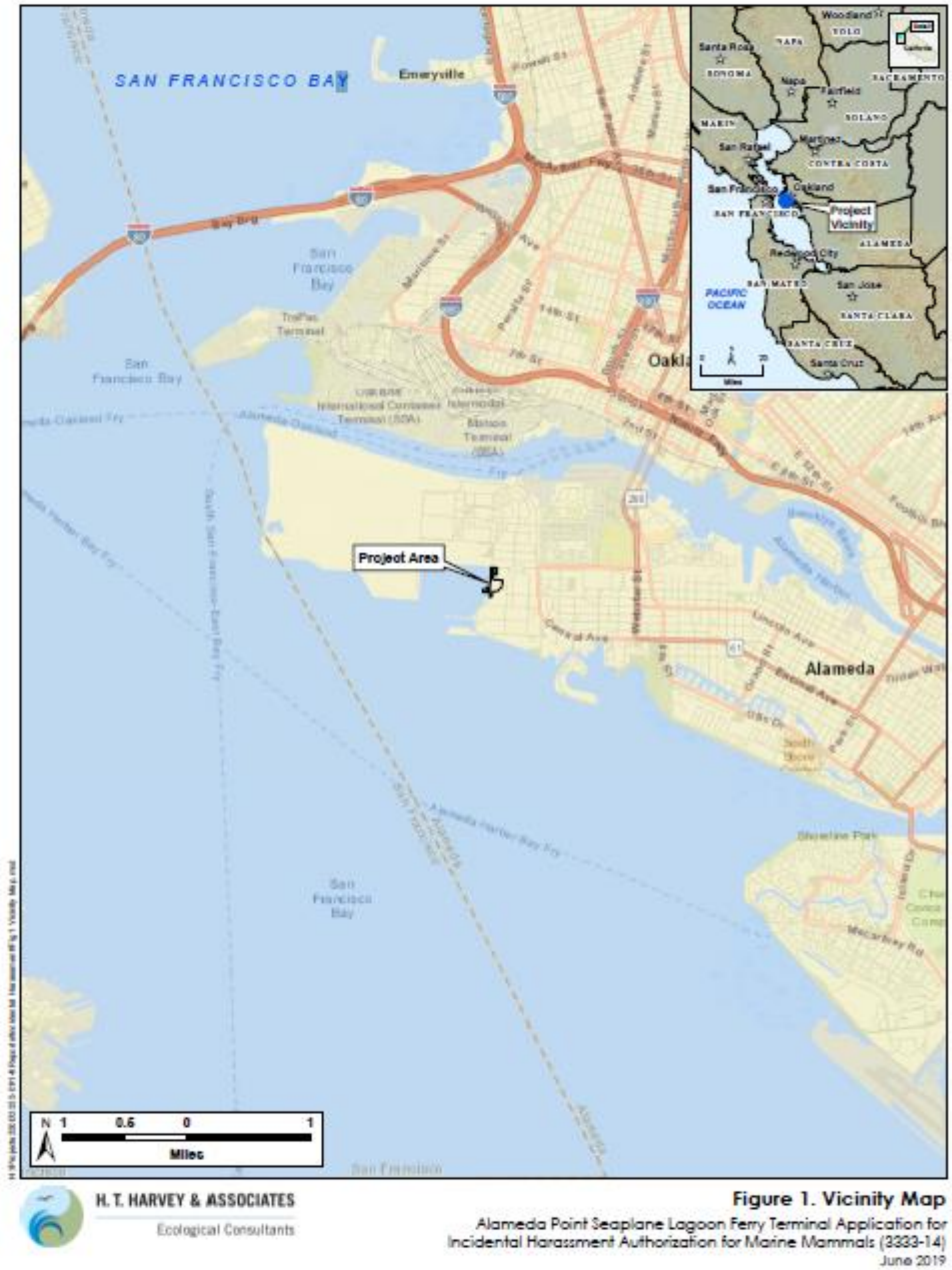

Figure 1. Project Location of Seaplane Lagoon Ferry Terminal in Alameda, California.

Detailed Description of Specific Activity

The Project encompasses both landside and waterside components, including the construction and operation of a new ferry terminal along the eastern edge of Seaplane Lagoon (see Figure 3 of the application). Only waterside components are discussed below. Please see the application for information on landside components.

A pier and abutment are required at the entrance to the ferry terminal to provide secure and safe entry from the land to the passenger access gangway (see Figure 3 of the application). The pier will extend out from the abutment to provide sufficient depth for the ferry vessels and float. The abutment will be located on the shoreline and will consist of a concrete abutment (24 feet (ft) long by 3 ft wide) supported on steel piles. The pier will be placed in the water and consist of a cast-in-place concrete structure (83.1 ft long by 20 ft wide) supported on piles with a perimeter guardrail. Approximately six 24-inch (in) diameter octagonal concrete piles offshore of the revetment and four 24-in diameter steel piles inshore of the revetment will be used for the pier. The abutment and pier deck will be installed above the high tide line.

The pier will be covered by a canopy similar to those on other San Francisco Bay Area WETA terminals in the San Francisco Bay Area. Dimensions would be longer than the pier by 16 ft (100 ft long by 20 ft wide), with an approximate height of 8.5 ft to 20 ft above the pier deck. The additional length would overhang the pier landside and shade the stairs up to the pier.

A gangway will connect the pier to the boarding float. The aluminum gangway (90 ft long by 10 ft wide) will be supported on the landside end of the pier by cantilevered seat supports, and the waterside end of the gangway will be supported by a boarding float. The finished walking surface, which will consist of fiberglass micromesh decking, will range in elevation from 8.4 ft at the pier to approximately 4.4 ft above the water surface on the boarding float.

The Seaplane Lagoon Ferry Terminal will include a boarding float where passengers will board and disembark from the ferry (see Figure 3 of the application). The float structure will be a steel pontoon barge (135 ft long by 42 ft wide by 8 ft deep) with internal compartments. Fenders and mooring cleats will be located around the perimeter of the float to accommodate vessel berthing scenarios. The float will be held in position with an arrangement of four 36-in diameter steel guide piles and two 36-in diameter steel fender piles, totaling six piles.

Piles will be installed for the abutment, pier, and float. The 36-in steel piles will be installed with a vibratory hammer, 24-in concrete piles will be installed with an impact hammer, and 14-in steel template piles will be installed with a vibratory hammer (see Table 1 below). The abutment piles will be installed from the landside, and are expected to require an impact hammer to penetrate the underlying material. Four steel piles (the abutment piles) will be installed above the high tide line and therefore are not discussed further.

Template piles will be used to support the in-water piles. These will consist of 12 to 18 14-inch steel H-type piles (see Table 1 below). One template typically includes four piles, but up to six template piles would be used at one time.

(see Table 1 below).

Table 1. Pile driving and removal activities for Seaplane Lagoon Ferry Terminal.

Description	Project Component			
	Temporary Template Pile Installation	Temporary Template Pile Removal	Permanent Pile Installation	Permanent Pile Installation
Diameter of Steel Pile (inches)	14	14	24	36
# of Piles	18	18	6	6

Vibratory Pile Driving				
Total Quantity	18	18	0	6
Max # Piles Vibrated per Day	6	6	0	1
Impact Pile Driving				
Total Quantity	0	0	6	0
Max # Piles Impacted per Day	0	0	1	0

For further details on the proposed action and project components, please refer to the application.

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

Description of Marine Mammals in the Area of Specified Activities

Sections 3 and 4 of the application summarize available information regarding status and trends, distribution and habitat preferences, and behavior and life history, of the potentially affected species. Additional information regarding population trends and threats may be found in NMFS's Stock Assessment Reports (SARs; *https://www.fisheries.noaa.gov/national/marine-mammal-protection/marine-mammal-stock-assessments*) and more general information about these species (*e.g.*, physical and behavioral descriptions) may be found on NMFS's website (*https://www.fisheries.noaa.gov/find*-species).

Table 2 lists all species with expected potential for occurrence in the project area and summarizes information related to the population or stock, including regulatory status under the MMPA and ESA and potential biological removal (PBR), where known. For taxonomy, we follow Committee on Taxonomy (2016). PBR is defined by the MMPA as the maximum number of animals, not including natural mortalities, that may be removed from a marine mammal stock while allowing that stock to reach or maintain its optimum sustainable population (as described in NMFS's SARs). While no mortality is anticipated or authorized here, PBR and annual serious injury and mortality from anthropogenic sources are included here as gross indicators of the status of the species and other threats.

Marine mammal abundance estimates presented in this document represent the total number of individuals that make up a given stock or the total number estimated within a particular study or survey area. NMFS's stock abundance estimates for most species represent the total estimate of individuals within the geographic area, if known, that comprises that stock. For some species, this geographic area may extend beyond U.S. waters. All managed stocks in this region are assessed in NMFS's U.S. Pacific and SARs (Carretta *et al*., 2018). All values presented in Table 2 are the most recent available at the time of publication (draft SARS available online at: *https://www.fisheries.noaa.gov/national/marine-mammal-protection/draft-marine-mammal-stock-assessment-reports*).

Table 2. Marine Mammals Occurrence in the Project Area.

Common name	Scientific name	Stock	ESA/MMPA status; Strategic (Y/N)[1]	Stock abundance (CV, Nmin, most recent abundance survey)[2]	PBR	Annual M/SI[3]
Order Cetartiodactyla – Cetacea – Superfamily Mysticeti (baleen whales)						
Family Eschrichtiidae						
Gray whale	*Eschrichtius robustus*	Eastern North Pacific	-/- ; N	26,960 (0.05, 25,849, 2016)	801	138
Family Balaenopteridae (rorquals)						
Humpback whale	*Megaptera novaeangliae*	California/Oregon/Washington	E/D ; Y	2,900 (0.048, 2,784, 2014)	16.7 (U.S. waters)	18.8
Superfamily Odontoceti (toothed whales, dolphins, and porpoises)						
Family Delphinidae						
Bottlenose dolphin	*Tursiops truncatus*	California Coastal	-/- ; N	453 (0.06, 346, 2011)	2.7	> 2

Family Phocoenidae (porpoises)						
Harbor porpoise	*Phocoena phocoena*	San Francisco-Russian River	-/- ; N	9,886 (0.51, 6,625, 2011)	66	0
Order Carnivora – Superfamily Pinnipedia						
Family Otariidae (eared seals and sea lions)						
California sea lion	*Zalophus californianus*	U.S.	-/- ; N	257,606 (n/a, 233,515, 2014)	14,011	≥319
Northern fur seal	*Callorhinus ursinus*	California	-/- ; N	14,050 (n/a, 7,524, 2013)	451	1.8
		Eastern North Pacific	-/- ; N	626,734 (n/a., 530,474, 2014)	11,405	1.1
Guadalupe fur seal	*Arctocephalus townsendi*	Mexico to California	T/D ; Y	20,000 (n/a, 15,830, 2010)	542	> 3.2
Family Phocidae (earless seals)						
Pacific harbor seal	*Phoca vitulina richardii*	California	-/- ; N	30,968 (n/a, 27,348, 2012)	1,641	43
Northern elephant seal	*Mirounga angustirostris*	California Breeding	-/- ; N	179,000 (n/a, 81,368, 2010)	4,882	8.8

1 - Endangered Species Act (ESA) status: Endangered (E), Threatened (T)/MMPA status: Depleted (D). A dash (-) indicates that the species is not listed under the ESA or designated as depleted under the MMPA. Under the MMPA, a strategic stock is one for which the level of direct human-caused mortality exceeds PBR or which is determined to be declining and likely to be listed under the ESA within the foreseeable future. Any species or stock listed under the ESA is automatically designated under the MMPA as depleted and as a strategic stock.
2- NMFS marine mammal stock assessment reports online at: www.nmfs.noaa.gov/pr/sars/. CV is coefficient of variation; Nmin is the minimum estimate of stock abundance. In some cases, CV is not applicable [explain if this is the case]
3 - These values, found in NMFS's SARs, represent annual levels of human-caused mortality plus serious injury from all sources combined (*e.g.*, commercial fisheries, ship strike). Annual M/SI often cannot be determined precisely and is in some cases presented as a minimum value or range. A CV associated with estimated mortality due to commercial fisheries is presented in some cases.
NOTE - Italicized species are not expected to be taken or proposed for authorization

All species that could potentially occur in the proposed survey areas are included in Table 2. However, the temporal and/or spatial occurrence of humpback whales and Guadalupe fur seals is such that take is not expected to occur, and they are not discussed further beyond the explanation provided here.

Humpback whales do enter San Francisco Bay to feed on schooling fish from late April through October, but are rarer visitors to the interior of San Francisco Bay. A recent, seasonal influx of humpback whales inside San Francisco Bay near the Golden Gate was recorded from April to November in 2016 and 2017 (Keener 2017). In May and June 2019, a lone humpback was observed in the waters off Alameda; however, this is a rare occurrence and the whale was thought to be in poor health. The whale was observed on May 27, 2019 in the Alameda Seaplane Lagoon, where it remained until June 5, 2019. It was determined to be an adult, and malnourished, based on the thin blubber layer. On June 6, 2019, the whale re-located to an area outside the Seaplane Lagoon, but still within the breakwater protecting the Alameda ferry docks and the USS Hornet. It remained there for 8 days, exhibiting the same suite of behaviors seen in the Seaplane Lagoon. On June 14, 2019, it left Alameda and moved farther out towards the main opening of the breakwater, near the open bay (The Marine Mammal Center (TMMC), B. Keener, pers. comm. 2019) and has not been observed since. It is unlikely that this humpback whale will be in the waters off Alameda when the project begins. NMFS does expect take to occur.

Guadalupe fur seals occasionally range into the waters of northern California and the Pacific Northwest. The Farallon Islands (off central California) and Channel Islands (off southern California) are used as haul outs during these movements (Simon 2016). Juvenile Guadalupe fur seals occasionally strand in the vicinity of San Francisco, especially during El Niño events. Most strandings along the California coast are animals younger than two years old, with evidence of malnutrition (NMFS 2017a). Because Guadalupe fur seals are highly rare in the area, and sightings are associated with abnormal weather conditions, such as El Niño events, NMFS has determined that no Guadalupe fur seals are likely to occur in the project vicinity and, therefore, no take is expected to occur.

Gray Whale

Gray whales are large baleen whales. They grow to approximately 50 ft in length and weigh up to 40 tons. They are one of the most frequently seen whales along the California coast, easily recognized by their mottled gray color and lack of dorsal fin. Adult whales carry heavy loads of attached barnacles, which add to their mottled appearance. Gray whales are divided into the Eastern North Pacific and Western North Pacific stocks. Both stocks migrate each year along the west coast of continental North America and Alaska. The Eastern North Pacific stock is much larger and is more likely to occur in the San Francisco Bay area. Western North Pacific Gray whales have summer and fall feeding grounds in the Okhotsk Sea off northeast Sakhalin Island, Russia, and off southeastern Kamchatka in the Bering Sea (NMFS 2017).

Gray whales are the only baleen whale known to feed on the sea floor, where they scoop up bottom sediments to filter out benthic crustaceans, mollusks, and worms (NMFS 2015). They feed in northern waters primarily off the Bering, Chukchi, and western Beaufort Seas during the summer. Between December and January, late-stage pregnant females, adult males, and immature females and males migrate southward to breeding areas around Mexico. The northward migration occurs between February and March. Coastal waters just outside San Francisco Bay are considered a migratory Biologically Important Area for the northward progression of gray whales (Calambokidis *et al.*, 2015). During this time, recently pregnant females, adult males, immature females, and females with calves move north to the feeding grounds (Calambokidis *et al.*, 2014). A few individuals enter into the San Francisco Bay during their northward migration. Foraging individuals in the San Francisco Bay may occur in small numbers in waters adjacent to Alameda Point, outside of the breakwaters, typically from December to May.

Since January 1, 2019, elevated gray whale strandings have occurred along the west coast of North America from Mexico through Alaska. This event has been declared an Unusual Mortality Event. As of June 21, 2019, 37 gray whales have stranded in California. Full or partial necropsy examinations were conducted on a subset of the whales. Preliminary findings in several of the whales have shown evidence of emaciation. These findings are not consistent across all of the whales examined, so more research is needed.

Bottlenose dolphins

Bottlenose dolphins are distributed world-wide in tropical and warm-temperate waters. In many regions, including California, separate coastal and offshore populations are known (Walker 1981; Ross and Cockcroft 1990; Van Waerebeek *et al*. 1990). The California coastal stock of bottlenose dolphins is distinct from the offshore stock, based on significant differences in genetics and cranial morphology (Perrin *et al*. 2011, Lowther-Thielking *et al*. 2015). California coastal bottlenose dolphins are found within about one kilometer (km) of shore (Hansen, 1990; Carretta *et al*. 1998; Defran and Weller 1999) with the range extending north over the last several decades related to El Niño events and increased ocean temperatures. As the range of bottlenose dolphins extended north, dolphins began entering the Bay in 2010 (Szczepaniak 2013). Until 2016, most bottlenose dolphins in San Francisco Bay were observed in the western Bay, from the Golden Gate Bridge to Oyster Point and Redwood City (Perlman 2017). Members of the California Coastal stock are transient and make movements up and down the coast into some estuaries, throughout the year.

Harbor Porpoise

Harbor porpoise are seldom found in waters warmer than 62.6 degrees Fahrenheit (17 degrees Celsius) (Read 1990) or south of Point Conception, and occurs as far north as the Bering Sea (Barlow and Hanan 1995; Carretta *et al*., 2017). The San Francisco-Russian River stock is found from Pescadero, 18 mi (30 km) south of the Bay, to 99 mi (160 km) north of the Bay at Point Arena (Carretta *et al*., 2017). In most areas, harbor porpoise occurs in small groups, consisting of just a few individuals.

Occasional sightings of harbor porpoises in the Bay, including near the Yerba Buena Island harbor seal haul-out site, were reported by the Caltrans marine mammal monitoring program beginning in 2008 (Caltrans 2018). Continued sightings from Caltrans and the Golden Gate Cetacean Research (GGCR) Organization suggests that the species is returning to San Francisco Bay after an absence of approximately 65 years (GGCR 2010). This re-immergence is not unique to San Francisco Bay, but rather indicative of the harbor porpoise in general along the west coast. GGCR has been issued a scientific research permit from NMFS for a multi-year assessment to document the population abundance and distribution in the Bay (82 FR 60374). Recent observations of harbor porpoises have been reported by GGCR researchers off Cavallo Point, outside Raccoon Strait between Tiburon and Angel Island, off Fort Point and as far into the Bay as Carquinez Strait (Perlman 2010). Based on the Caltrans and GGCR monitoring, over 100 porpoises were seen at one time entering San Francisco Bay; and over 600 individual animals have been documented in a photo-ID database. Reported sightings are concentrated in the vicinity of the Golden Gate Bridge and Angel Island, with lesser numbers sighted south of Alcatraz and west of Treasure Island (AECOM 2017).

Harbor Seal

Harbor seals are found from Baja California to the eastern Aleutian Islands of Alaska. The species primarily hauls out on remote mainland and island beaches and reefs, and estuary areas. Harbor seals tend to forage locally within 53 miles (mi) (85 km) of haul-out sites (Harvey and Goley 2011). Harbor seal is the most common marine mammal species observed in the Bay and individuals are commonly seen near the San Francisco-Oakland Bay Bridge east span (CalTrans 2013b, 2013c). Tagging studies have shown that most seals tagged in the Bay remain in the Bay (Harvey and Goley 2011; Manugian 2013). Foraging often occurs in the Bay, as noted by observations of seals exhibiting foraging behavior (short dives less than five minutes, moving back and forth in an area, and sometimes tearing up prey at the surface). Moderate to small numbers are known to forage in Seaplane Lagoon.

Although solitary in the water, harbor seals come ashore at haul outs to rest, socialize, breed, nurse, molt, and thermoregulate. Habitats used as haul out sites include tidal rocks, bayflats, sandbars, and sandy beaches (Zeiner *et al.*, 1990). Haul out sites are relatively consistent from year to year (Kopec and Harvey 1995) and females have been recorded returning to their own natal haul out to breed (Cunningham *et al.*, 2009). Although harbor seals haul out at approximately 20 locations around San Francisco Bay, there are three primary sites: Mowry Slough in the South Bay, Corte Madera Marsh and Castro Rocks in the North Bay, and Yerba Buena Island in the Central Bay (Grigg 2008; Gibble 2011). Yerba Buena Island haul out is located approximately five mi north project area. Harbor seals use Yerba Buena Island year-round, with the largest numbers seen during winter months, when Pacific herring spawn (Grigg 2008). Two known pinniped haul-out sites in the vicinity of the project area are located on an existing haul out platform approximately 0.5 mi southeast of the project area (separated from project activities by approximately 0.3 mi of developed areas on-land), and at the western end of Breakwater Island, approximately 1.0 mi southwest of the pile driving activities (see Figure 4 of the application).

California Sea Lion

California sea lions breed on the offshore islands of California from May through July (Heath and Perrin 2009). During the non-breeding season, adult and sub-adult males and juveniles migrate northward along the coast, to central and northern California, Oregon, Washington, and Vancouver Island (Jefferson *et al*., 1993). They return south the following spring (Lowry and Forney 2005; Heath and Perrin 2009). Females and some juveniles tend to remain closer to rookeries (Antonelis *et al*., 1990; Melin *et al*., 2008).

In San Francisco Bay, California sea lions have been observed at Angel Island and occupying the docks near Pier 39 which is the largest California sea lion haul-out in San Francisco Bay. A maximum of 1,706 sea lions were counted at Pier 39 in 2009. However, since then the population has averaged at about 50-300 depending upon the season (TMMC 2017). This group of sea lions has decreased in size in recent years, coincident with a fluctuating decrease in the herring population in the Bay. There are no known breeding sites within San Francisco Bay. Their primary breeding site is in the Channel Islands (USACE 2011). The sea lions appear at Pier 39 after returning from the Channel Islands at the beginning of August (Bauer 1999). No other sea lion haul out sites have been identified in the Bay and no pupping has been observed at the Pier 39 site or any other site in San Francisco Bay under normal conditions (USACE 2011). Although there has been documentation of pupping on docks in the Bay, this event was during a domoic acid event. There is no reason to anticipate that any domoic events will occur during the project construction activities.

The project site is approximately 4 mi away from Pier 39. Although there is little information regarding the foraging behavior of the California sea lion in southern San Francisco Bay, they have been observed foraging on a regular basis in the shipping channel south of Yerba Buena Island.

Foraging grounds have also been identified for pinnipeds, including sea lions, between Yerba Buena Island and Treasure Island, as well as off the Tiburon Peninsula (Caltrans, 2006). The California sea lions that use the Pier 39 haul-out site may be feeding on Pacific herring (*Clupea harengus*), northern anchovy, and other prey in the waters of San Francisco Bay

(Caltrans, 2013a). In addition to the Pier 39 haul-out, California sea lions haul out on buoys and similar structures throughout San Francisco Bay. They mainly are seen swimming off the San Francisco and Marin shorelines within San Francisco Bay, but may occasionally enter the project area to forage and could possibly haul-out on nearby breakwater islands or platforms.

Northern Elephant Seal

The northern elephant seal is common on California coastal mainland and island sites, where the species pups, breeds, rests, and molts. The largest rookeries are on San Nicolas and San Miguel islands in the northern Channel Islands. Near the Bay, elephant seals breed, molt, and haul out at Año Nuevo Island, the Farallon Islands, and Point Reyes National Seashore.

Northern elephant seals haul out to give birth and breed from December through March. Pups remain onshore or in adjacent shallow water through May. Both sexes make two foraging migrations each year: One after breeding and the second after molting (Stewart 1989; Stewart and DeLong 1995). Adult females migrate to the central North Pacific to forage, and males migrate to the Gulf of Alaska to forage (Robinson *et al*. 2012). Pup mortality is high when they make the first trip to sea in May, and this period correlates with the time of most strandings. Pups of the year return in the late summer and fall, to haul out at breeding rookery and small haul out sites, but occasionally they may make brief stops in the Bay.

Generally, only juvenile elephant seals enter the Bay and do not remain long. The most recent sighting near the project area was in 2012, on the beach at Clipper Cove on Treasure Island (5 mi north of the project area), when a healthy yearling elephant seal hauled out for approximately 1 day. Approximately 100 juvenile northern elephant seals strand in or near the Bay each year, including individual strandings at Yerba Buena Island and Treasure Island (less than 10 strandings per year).

Northern Fur Seal

Northern fur seal breeds on the offshore islands of California and in the Bering Sea from May through July. Two stocks of Northern fur seals may occur near the Bay, the California and Eastern Pacific stocks. The California stock breeds, pups, and forages off the California coast. The Eastern Pacific stock breeds and pups on islands in the Bering Sea, but females and juveniles move south to California waters to forage in the fall and winter months.

Both the California and Eastern Pacific stocks forage in the offshore waters of California, but only sick, emaciated, or injured fur seals enter the Bay. The Marine Mammal Center (TMMC) occasionally picks up stranded fur seals around Yerba Buena Island and Treasure Island.

Marine Mammal Hearing

Hearing is the most important sensory modality for marine mammals underwater, and exposure to anthropogenic sound can have deleterious effects. To appropriately assess the potential effects of exposure to sound, it is necessary to understand the frequency ranges marine mammals are able to hear. Current data indicate that not all marine mammal species have equal hearing capabilities (*e.g.*, Richardson *et al.*, 1995; Wartzok and Ketten, 1999; Au and Hastings, 2008). To reflect this, Southall *et al.* (2007) recommended that marine mammals be divided into functional hearing groups based on directly measured or estimated hearing ranges on the basis of available behavioral response data, audiograms derived using auditory evoked potential techniques, anatomical modeling, and other data. Note that no direct measurements of hearing ability have been successfully completed for mysticetes (*i.e*., low-frequency cetaceans). Subsequently, NMFS (2018) described generalized hearing ranges for these marine mammal hearing groups. Generalized hearing ranges were chosen based on the approximately 65 decibel (dB) threshold from the normalized composite audiograms, with the exception for lower limits for low-frequency cetaceans where the lower bound was deemed to be biologically implausible and the lower bound from Southall *et al.* (2007) retained. Marine mammal hearing groups and their associated hearing ranges are provided in Table 3.

Table 3. Marine Mammal Hearing Groups (NMFS 2018).

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

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

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

For more detail concerning these groups and associated frequency ranges, please see NMFS (2018) for a review of available information. Seven marine mammal species (3 cetacean and 4 pinniped (2 otariid and 2 phocid) species) have the reasonable potential to occur during the proposed activities. Please refer to Table 2. Of the cetacean species that may be present, one is classified as low-frequency cetacean (*i.e.*, all mysticete species), one is classified as mid-frequency cetacean (*i.e*., all delphinid species), and one is classified as high-frequency cetacean (*i.e*., harbor porpoise).

Potential Effects of Specified Activities on Marine Mammals and their Habitat

This section includes a summary and discussion of the ways that components of the specified activity may impact marine mammals and their habitat. The *Estimated Take by Incidental Harassment* section later in this document includes a quantitative analysis of the number of individuals that are expected to be taken by this activity. The *Negligible Impact Analysis and Determination* section considers the content of this section, the *Estimated Take by Incidental Harassment* section, and the *Proposed Mitigation* section, to draw conclusions regarding the likely impacts of these activities on the reproductive success or survivorship of individuals and how those impacts on individuals are likely to impact marine mammal species or stocks.

Acoustic effects on marine mammals during the specified activity can occur from vibratory and impact pile driving. The effects of underwater noise from the City's proposed activities have the potential to result in Level B harassment of marine mammals in the vicinity of the action area.

Description of Sound Sources

This section contains a brief technical background on sound, on the characteristics of certain sound types, and on metrics used in this proposal inasmuch as the information is relevant to the specified activity and to a discussion of the potential effects of the specified activity on marine mammals found later in this document. For general information on sound and its interaction with the marine environment, please see, *e.g.*, Au and Hastings (2008); Richardson *et al*. (1995); Urick (1983).

Sound travels in waves, the basic components of which are frequency, wavelength, velocity, and amplitude. Frequency is the number of pressure waves that pass by a reference point per unit of time and is measured in hertz (Hz) or cycles per second. Wavelength is the distance between two peaks or corresponding points of a sound wave (length of one cycle). Higher frequency sounds have shorter wavelengths than lower frequency sounds, and typically attenuate (decrease) more rapidly, except in certain cases in shallower water. Amplitude is the height of the sound pressure wave or the "loudness" of a sound and is typically described using the relative unit of the decibel (dB). A sound pressure level (SPL) in dB is described as the ratio between a measured pressure and a reference pressure (for underwater sound, this is 1 microPascal (μPa)), and is a logarithmic unit that accounts for large variations in amplitude; therefore, a relatively small change in dB corresponds to large changes in sound pressure. The source level (SL) represents the SPL referenced at a distance of 1 m from the source (referenced to 1 μPa), while the received level is the SPL at the listener's position (referenced to 1 μPa).

Root mean square (rms) is the quadratic mean sound pressure over the duration of an impulse. Rms is calculated by squaring all of the sound amplitudes, averaging the squares, and then taking the square root of the average (Urick, 1983). Rms accounts for both positive and negative values; squaring the pressures makes all values positive so that they may be accounted for in the summation of pressure levels (Hastings and Popper, 2005). This measurement is often used in the context of discussing behavioral effects, in part because behavioral effects, which often result from auditory cues, may be better expressed through averaged units than by peak pressures.

Sound exposure level (SEL; represented as dB re 1 μPa^2-s) represents the total energy in a stated frequency band over a stated time interval or event, and considers both intensity and duration of exposure. The per-pulse SEL is calculated over the time window containing the entire pulse (*i.e.*, 100 percent of the acoustic energy). SEL is a cumulative metric; it can be accumulated over a single pulse, or calculated over periods containing multiple pulses. Cumulative SEL represents the total energy accumulated by a receiver over a defined time window or during an event. Peak sound pressure (also referred to as zero-to-peak sound pressure or 0-pk) is the maximum instantaneous sound pressure measurable in the water at a specified distance from the source, and is represented in the same units as the rms sound pressure.

When underwater objects vibrate or activity occurs, sound-pressure waves are created. These waves alternately compress and decompress the water as the sound wave travels. Underwater sound waves radiate in a manner similar to ripples on the surface of a pond and may be either directed in a beam or beams or may radiate in all directions (omnidirectional sources), as is the case for sound produced by the pile driving activity considered here. The compressions and decompressions associated with sound waves are detected as changes in pressure by aquatic life and man-made sound receptors such as hydrophones.

Even in the absence of sound from the specified activity, the underwater environment is typically loud due to ambient sound, which is defined as environmental background sound levels lacking a single source or point (Richardson *et al*., 1995). The sound level of a region is defined by the total acoustical energy being generated by known and unknown sources. These sources may include physical (*e.g.*, wind and waves, earthquakes, ice, atmospheric sound), biological (*e.g.*, sounds produced by marine mammals, fish, and invertebrates), and anthropogenic (*e.g.*, vessels, dredging, construction) sound. A number of sources contribute to ambient sound, including wind and waves, which are a main source of naturally occurring ambient sound for frequencies between 200 hertz (Hz) and 50 kilohertz (kHz) (Mitson, 1995). In general, ambient sound levels tend to increase with increasing wind speed and wave height. Precipitation can become an important component of total sound at frequencies above 500 Hz, and possibly down to 100 Hz during quiet times. Marine mammals can contribute significantly to ambient sound levels, as can some fish and snapping shrimp. The frequency band for biological contributions is from approximately 12 Hz to over 100 kHz. Sources of ambient sound related to human activity include transportation (surface vessels), dredging and construction, oil and gas drilling and production, geophysical surveys, sonar, and explosions. Vessel noise typically dominates the total ambient sound for frequencies between 20 and 300 Hz. In general, the frequencies of anthropogenic sounds are below 1 kHz and, if higher frequency sound levels are created, they attenuate rapidly.

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

Sounds are often considered to fall into one of two general types: pulsed and non-pulsed (defined in the following). The distinction between these two sound types is important because they have differing potential to cause physical effects, particularly with regard to hearing (*e.g*., Ward, 1997 in Southall *et al*., 2007). Please see Southall *et al*. (2007) for an in-depth discussion of these concepts. The distinction between these two sound types is not always obvious, as certain signals share properties of both pulsed and non-pulsed sounds. A signal near a source could be categorized as a pulse, but due to propagation effects as it moves farther from the source, the signal duration becomes longer (*e.g.*, Greene and Richardson, 1988).

Pulsed sound sources (*e.g.*, airguns, explosions, gunshots, sonic booms, impact pile driving) produce signals that are brief (typically considered to be less than one second), broadband, atonal transients (ANSI, 1986, 2005; Harris, 1998; NIOSH, 1998; ISO, 2003) and occur either as isolated events or repeated in some succession. Pulsed sounds are all characterized by a relatively rapid rise from ambient pressure to a maximal pressure value followed by a rapid decay period that may include a period of diminishing, oscillating maximal and minimal pressures, and generally have an increased capacity to induce physical injury as compared with sounds that lack these features.

Non-pulsed sounds can be tonal, narrowband, or broadband, brief or prolonged, and may be either continuous or intermittent (ANSI, 1995; NIOSH, 1998). Some of these non-pulsed sounds can be transient signals of short duration but without the essential properties of pulses (*e.g*., rapid rise time). Examples of non-pulsed sounds include those produced by vessels, aircraft, machinery operations such as drilling or dredging, vibratory pile driving, and active sonar systems. The duration of such sounds, as received at a distance, can be greatly extended in a highly reverberant environment.

The impulsive sound generated by impact hammers is characterized by rapid rise times and high peak levels. Vibratory hammers produce non-impulsive, continuous noise at levels significantly lower than those produced by impact hammers. Rise time is slower, reducing the probability and severity of injury, and sound energy is distributed over a greater amount of time (*e.g.*, Nedwell and Edwards, 2002; Carlson *et al*., 2005).

Acoustic Effects on Marine Mammals

We previously provided general background information on marine mammal hearing (see *Description of Marine Mammals in the Area of the Specified Activity*). Here, we discuss the potential effects of sound on marine mammals.

Note that, in the following discussion, we refer in many cases to a review article concerning studies of noise-induced hearing loss conducted from 1996-2015 (*i.e.*, Finneran, 2015). For study-specific citations, please see that work. Anthropogenic sounds cover a broad range of frequencies and sound levels and can have a range of highly variable impacts on marine life, from none or minor to potentially severe responses, depending on received levels, duration of exposure, behavioral context, and various other factors. The potential effects of underwater sound from active acoustic sources can potentially result in one or more of the following: temporary or permanent hearing impairment, non-auditory physical or physiological effects, behavioral disturbance, stress, and masking (Richardson *et al*., 1995; Gordon *et al*., 2004; Nowacek *et al*., 2007; Southall *et al*., 2007; Götz *et al*., 2009). The degree of effect is intrinsically related to the signal characteristics, received level, distance from the source, and duration of the sound exposure. In general, sudden, high level sounds can cause hearing loss, as can longer exposures to lower level sounds. Temporary or permanent loss of hearing will occur almost exclusively for noise within an animal's hearing range. We first describe specific manifestations of acoustic effects before providing discussion specific to pile driving and removal activities.

Richardson *et al*. (1995) described zones of increasing intensity of effect that might be expected to occur, in relation to distance from a source and assuming that the signal is within an animal's hearing range. First is the area within which the acoustic signal would be audible (potentially perceived) to the animal but not strong enough to elicit any overt behavioral or physiological response. The next zone corresponds with the area where the signal is audible to the animal and of sufficient intensity to elicit behavioral or physiological responsiveness. Third is a zone within which, for signals of high intensity, the received level is sufficient to potentially cause discomfort or tissue damage to auditory or other systems. Overlaying these zones to a certain extent is the area within which masking (*i.e.*, when a sound interferes with or masks the ability of an animal to detect a signal of interest that is above the absolute hearing threshold) may occur; the masking zone may be highly variable in size.

We describe the more severe effects (*i.e.*, certain non-auditory physical or physiological effects) only briefly as we do not expect that there is a reasonable likelihood that pile driving may result in such effects (see below for further discussion). Potential effects from explosive impulsive sound sources can range in severity from effects such as behavioral disturbance or tactile perception to physical discomfort, slight injury of the internal organs and the auditory system, or mortality (Yelverton *et al*., 1973). Non-auditory physiological effects or injuries that theoretically might occur in marine mammals exposed to high level underwater sound or as a secondary effect of extreme behavioral reactions (*e.g.*, change in dive profile as a result of an avoidance reaction) caused by exposure to sound include neurological effects, bubble formation, resonance effects, and other types of organ or tissue damage (Cox *et al*., 2006; Southall *et al*., 2007; Zimmer and Tyack, 2007; Tal *et al*., 2015). The construction activities considered here do not involve the use of devices such as explosives or mid-frequency tactical sonar that are associated with these types of effects.

Threshold Shift – Marine mammals exposed to high-intensity sound, or to lower-intensity sound for prolonged periods, can experience hearing threshold shift (TS), which is the loss of hearing sensitivity at certain frequency ranges (Finneran, 2015). TS can be permanent (PTS), in which case the loss of hearing sensitivity is not fully recoverable, or temporary (TTS), in which case the animal's hearing threshold would recover over time (Southall *et al*., 2007). Repeated sound exposure that leads to TTS could cause PTS. In severe cases of PTS, there can be total or partial deafness, while in most cases the animal has an impaired ability to hear sounds in specific frequency ranges (Kryter, 1985).

When PTS occurs, there is physical damage to the sound receptors in the ear (*i.e.*, tissue damage), whereas TTS represents primarily tissue fatigue and is reversible (Southall *et al*., 2007). In addition, other investigators have suggested that TTS is within the normal bounds of physiological variability and tolerance and does not represent physical injury (*e.g.*, Ward, 1997). Therefore, NMFS does not consider TTS to constitute auditory injury.

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

TTS is the mildest form of hearing impairment that can occur during exposure to sound (Kryter, 1985). While experiencing TTS, the hearing threshold rises, and a sound must be at a higher level in order to be heard. In terrestrial and marine mammals, TTS can last from minutes or hours to days (in cases of strong TTS). In many cases, hearing sensitivity recovers rapidly after exposure to the sound ends. Few data on sound levels and durations necessary to elicit mild TTS have been obtained for marine mammals.

Marine mammal hearing plays a critical role in communication with conspecifics, and interpretation of environmental cues for purposes such as predator avoidance and prey capture. Depending on the degree (elevation of threshold in dB), duration (*i.e*., recovery time), and frequency range of TTS, and the context in which it is experienced, TTS can have effects on marine mammals ranging from discountable to serious. For example, a marine mammal may be able to readily compensate for a brief, relatively small amount of TTS in a non-critical frequency range that occurs during a time where ambient noise is lower and there are not as many competing sounds present. Alternatively, a larger amount and longer duration of TTS sustained during time when communication is critical for successful mother/calf interactions could have more serious impacts.

Currently, TTS data only exist for four species of cetaceans (bottlenose dolphin (*Tursiops truncatus*), beluga whale (*Delphinapterus leucas*), harbor porpoise, and Yangtze finless porpoise (*Neophocoena asiaeorientalis*)) and three species of pinnipeds (northern elephant seal, harbor seal, and California sea lion) exposed to a limited number of sound sources (*i.e.*, mostly tones and octave-band noise) in laboratory settings (Finneran, 2015). TTS was not observed in trained spotted (*Phoca largha*) and ringed (*Pusa hispida*) seals exposed to impulsive noise at levels matching previous predictions of TTS onset (Reichmuth *et al*., 2016). In general, harbor seals and harbor porpoises have a lower TTS onset than other measured pinniped or cetacean species (Finneran, 2015). Additionally, the existing marine mammal TTS data come from a limited number of individuals within these species. There are no data available on noise-induced hearing loss for mysticetes. For summaries of data on TTS in marine mammals or for further discussion of TTS onset thresholds, please see Southall *et al*. (2007), Finneran and Jenkins (2012), Finneran (2015), and NMFS (2018).

Behavioral Effects – Behavioral disturbance may include a variety of effects, including subtle changes in behavior (*e.g.*, minor or brief avoidance of an area or changes in vocalizations), more conspicuous changes in similar behavioral activities, and more sustained and/or potentially severe reactions, such as displacement from or abandonment of high-quality habitat. Behavioral responses to sound are highly variable and context-specific and any reactions depend on numerous intrinsic and extrinsic factors (*e.g.*, species, state of maturity, experience, current activity, reproductive state, auditory sensitivity, time of day), as well as the interplay between factors (*e.g.*, Richardson *et al*., 1995; Wartzok *et al*., 2003; Southall *et al*., 2007; Weilgart, 2007; Archer *et al*., 2010). Behavioral reactions can vary not only among individuals but also within an individual, depending on previous experience with a sound source, context, and numerous other factors (Ellison *et al*., 2012), and can vary depending on characteristics associated with the sound source (*e.g.*, whether it is moving or stationary, number of sources, distance from the source).

Please see Appendices B-C of Southall *et al*. (2007) for a review of studies involving marine mammal behavioral responses to sound.

Habituation can occur when an animal's response to a stimulus wanes with repeated exposure, usually in the absence of unpleasant associated events (Wartzok *et al*., 2003). Animals are most likely to habituate to sounds that are predictable and unvarying. It is important to note that habituation is appropriately considered as a "progressive reduction in response to stimuli that are perceived as neither aversive nor beneficial," rather than as, more generally, moderation in response to human disturbance (Bejder *et al*., 2009). The opposite process is sensitization, when an unpleasant experience leads to subsequent responses, often in the form of avoidance, at a lower level of exposure. As noted, behavioral state may affect the type of response. For example, animals that are resting may show greater behavioral change in response to disturbing sound levels than animals that are highly motivated to remain in an area for feeding (Richardson *et al*., 1995; NRC, 2003; Wartzok *et al*., 2003). Controlled experiments with captive marine mammals have showed pronounced behavioral reactions, including avoidance of loud sound sources (Ridgway *et al*., 1997; Finneran *et al*., 2003). Observed responses of wild marine mammals to loud pulsed sound sources (typically airguns or acoustic harassment devices) have been varied but often consist of avoidance behavior or other behavioral changes suggesting discomfort (Morton and Symonds, 2002; see also Richardson *et al*., 1995; Nowacek *et al*., 2007). However, many delphinids approach low-frequency airgun source vessels with no apparent discomfort or obvious behavioral change (*e.g.*, Barkaszi *et al*., 2012), indicating the importance of frequency output in relation to the species' hearing sensitivity.

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

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

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

Variations in respiration naturally vary with different behaviors and alterations to breathing rate as a function of acoustic exposure can be expected to co-occur with other behavioral reactions, such as a flight response or an alteration in diving. However, respiration rates in and of themselves may be representative of annoyance or an acute stress response. Various studies have shown that respiration rates may either be unaffected or could increase, depending on the species and signal characteristics, again highlighting the importance in understanding species differences in the tolerance of underwater noise when determining the potential for impacts resulting from anthropogenic sound exposure (*e.g.*, Kastelein *et al*., 2001, 2005, 2006; Gailey *et al*., 2007; Gailey *et al*., 2016).

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

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

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

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

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

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

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

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

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

Auditory Masking – Sound can disrupt behavior through masking, or interfering with, an animal's ability to detect, recognize, or discriminate between acoustic signals of interest (*e.g.*, those used for intraspecific communication and social interactions, prey detection, predator avoidance, navigation) (Richardson *et al*., 1995; Erbe *et al*., 2016). Masking occurs when the receipt of a sound is interfered with by another coincident sound at similar frequencies and at similar or higher intensity, and may occur whether the sound is natural (*e.g.*, snapping shrimp, wind, waves, precipitation) or anthropogenic (*e.g.*, shipping, sonar, seismic exploration) in origin. The ability of a noise source to mask biologically important sounds depends on the characteristics of both the noise source and the signal of interest (*e.g.*, signal-to-noise ratio, temporal variability, direction), in relation to each other and to an animal's hearing abilities (*e.g.*, sensitivity, frequency range, critical ratios, frequency discrimination, directional discrimination, age or TTS hearing loss), and existing ambient noise and propagation conditions.

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

The frequency range of the potentially masking sound is important in determining any potential behavioral impacts. For example, low-frequency signals may have less effect on high-frequency echolocation sounds produced by odontocetes but are more likely to affect detection of mysticete communication calls and other potentially important natural sounds such as those produced by surf and some prey species. The masking of communication signals by anthropogenic noise may be considered as a reduction in the communication space of animals (*e.g.*, Clark *et al*., 2009) and may result in energetic or other costs as animals change their vocalization behavior (*e.g*., Miller *et al*., 2000; Foote *et al*., 2004; Parks *et al*., 2007; Di Iorio and Clark, 2009; Holt *et al*., 2009). Masking can be reduced in situations where the signal and noise come from different directions (Richardson *et al*., 1995), through amplitude modulation of the signal, or through other compensatory behaviors (Houser and Moore, 2014). Masking can be tested directly in captive species (*e.g.*, Erbe, 2008), but in wild populations it must be either modeled or inferred from evidence of masking compensation. There are few studies addressing real-world masking sounds likely to be experienced by marine mammals in the wild (*e.g.*, Branstetter *et al*., 2013).

Masking affects both senders and receivers of acoustic signals and can potentially have long-term chronic effects on marine mammals at the population level as well as at the individual level. Low-frequency ambient sound levels have increased by as much as 20 dB (more than three times in terms of SPL) in the world's ocean from pre-industrial periods, with most of the increase from distant commercial shipping (Hildebrand, 2009). All anthropogenic sound sources, but especially chronic and lower-frequency signals (*e.g.*, from vessel traffic), contribute to elevated ambient sound levels, thus intensifying masking.

Potential Effects of the City's Activity – As described previously (see *Description of Active Acoustic Sound Sources*), the City proposes to conduct pile driving, including impact and vibratory driving. The effects of pile driving on marine mammals are dependent on several factors, including the size, type, and depth of the animal; the depth, intensity, and duration of the pile driving sound; the depth of the water column; the substrate of the habitat; the standoff distance between the pile and the animal; and the sound propagation properties of the environment. With both types, it is likely that the pile driving could result in temporary, short term changes in an animal's typical behavioral patterns and/or avoidance of the affected area. These behavioral changes may include (Richardson *et al*., 1995): changing durations of surfacing and dives, number of blows per surfacing, or moving direction and/or speed; reduced/increased vocal activities; changing/cessation of certain behavioral activities (such as socializing or feeding); visible startle response or aggressive behavior (such as tail/fluke slapping or jaw clapping); avoidance of areas where sound sources are located; and/or flight responses.

The biological significance of many of these behavioral disturbances is difficult to predict, especially if the detected disturbances appear minor. However, the consequences of behavioral modification could be expected to be biologically significant if the change affects growth, survival, or reproduction. Significant behavioral modifications that could lead to effects on growth, survival, or reproduction, such as drastic changes in diving/surfacing patterns or significant habitat abandonment are extremely unlikely in this area (*i.e.*, shallow waters in modified industrial areas).

Whether impact or vibratory driving, sound sources would be active for relatively short durations, with relation to potential for masking. The frequencies output by pile driving activity are lower than those used by most species expected to be regularly present for communication or foraging. We expect insignificant impacts from masking, and any masking event that could possibly rise to Level B harassment under the MMPA would occur concurrently within the zones of behavioral harassment already estimated for vibratory and impact pile driving, and which have already been taken into account in the exposure analysis.

Anticipated Effects on Marine Mammal Habitat

The proposed activities would not result in permanent impacts to habitats used directly by marine mammals except the actual footprint of the project. The footprint of the project is small, and equal to the area the ferry associated pile placement. The installation of piles for the new pier will result in permanent impacts on 61 square feet (ft^2) of aquatic habitat. At best, the impact area, which is located in Seaplane Lagoon, provides marginal foraging habitat for marine mammals and fish. The net loss of such a small area (25 ft^2) of benthic habitat is not expected to impair the health of these species or affect their populations. Project construction and long-term operation are not expected to disturb nearby harbor seal haul-outs, which are located 1.0 mi to the southwest on Breakwater Island and 0.5 mi to the southeast on a platform installed by the City.

The proposed activities may have potential short-term impacts to food sources such as forage fish. The proposed activities could also affect acoustic habitat (see masking discussion above), but meaningful impacts are unlikely. There are no known foraging hotspots, or other ocean bottom structures of significant biological importance to marine mammals present in the marine waters in the vicinity of the project areas. Therefore, the main impact issue associated with the proposed activity would be temporarily elevated sound levels and the associated direct effects on marine mammals, as discussed previously. The most likely impact to marine mammal habitat occurs from pile driving effects on likely marine mammal prey (*i.e.*, fish) near where the piles are installed. Impacts to the immediate substrate during installation and removal of piles are anticipated, but these would be limited to minor, temporary suspension of sediments, which could impact water quality and visibility for a short amount of time, but which would not be expected to have any effects on individual marine mammals. Impacts to substrate are therefore not discussed further.

Effects to Prey – Sound may affect marine mammals through impacts on the abundance, behavior, or distribution of prey species (*e.g.*, crustaceans, cephalopods, fish, zooplankton). Marine mammal prey varies by species, season, and location and, for some, is not well documented. Here, we describe studies regarding the effects of noise on known marine mammal prey.

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

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

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

The action area supports marine habitat for prey species including large populations of anadromous fish including Pacific salmon (five species), cutthroat and steelhead trout, and Dolly Varden (NMFS 2018) and other species of marine fish such as halibut, rock sole, sculpins, Pacific cod, herring, and eulachon (NMFS 2018). The most likely impact to fish from pile driving activities at the project areas would be temporary behavioral avoidance of the area. The duration of fish avoidance of an area after pile driving stops is unknown, but a rapid return to normal recruitment, distribution and behavior is anticipated. In general, impacts to marine mammal prey species are expected to be minor and temporary due to the expected short daily duration of individual pile driving events and the relatively small areas being affected.

The area impacted by the project is relatively small compared to the available habitat in San Francisco Bay. Any behavioral avoidance by fish of the disturbed area would still leave significantly large areas of fish and marine mammal foraging habitat in the nearby vicinity. As described in the preceding, the potential for the City's construction to affect the availability of prey to marine mammals or to meaningfully impact the quality of physical or acoustic habitat is considered to be insignificant. Effects to habitat will not be discussed further in this document.

Estimated Take

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

Except with respect to certain activities not pertinent here, section 3(18) of the MMPA defines "harassment" as any act of pursuit, torment, or annoyance, which (i) has the potential to injure a marine mammal or marine mammal stock in the wild (Level A harassment); or (ii) has the potential to disturb a marine mammal or marine mammal stock in the wild by causing disruption of behavioral patterns, including, but not limited to, migration, breathing, nursing, breeding, feeding, or sheltering (Level B harassment).

Take of marine mammals incidental to the City's pile driving and removal activities could occur as a result of Level B harassment. Below we describe how the potential take is estimated. As described previously, no mortality is anticipated or proposed to be authorized for this activity. Below we describe how the take is estimated.

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

Acoustic Thresholds

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

Level B Harassment – Though significantly driven by received level, the onset of behavioral disturbance from anthropogenic noise exposure is also informed to varying degrees by other factors related to the source (*e.g.*, frequency, predictability, duty cycle), the environment (*e.g.*, bathymetry), and the receiving animals (hearing, motivation, experience, demography, behavioral context) and can be difficult to predict (Southall *et al.*, 2007, Ellison *et al.*, 2012). Based on what the available science indicates and the practical need to use a threshold based on a factor that is both predictable and measurable for most activities, NMFS uses a generalized acoustic threshold based on received level to estimate the onset of behavioral harassment. NMFS predicts that marine mammals are likely to be behaviorally harassed in a manner we consider Level B harassment when exposed to underwater anthropogenic noise above received levels of 120 dB re 1 μPa (rms) for continuous (*e.g.*, vibratory pile driving) and above 160 dB re 1 μPa (rms) for impulsive sources (*e.g.*, impact pile driving). The City's proposed activity includes the use of continuous (vibratory pile driving) and impulsive (impact pile driving) sources, and therefore the 120 and 160 dB re 1 μPa (rms) are applicable.

Level A harassment - NMFS' *Technical Guidance for Assessing the Effects of Anthropogenic Sound on Marine Mammal Hearing* (Version 2.0) (Technical Guidance, 2018) identifies dual criteria to assess auditory injury (Level A harassment) to five different marine mammal groups (based on hearing sensitivity) as a result of exposure to noise. The technical guidance identifies the received levels, or thresholds, above which individual marine mammals are predicted to experience changes in their hearing sensitivity for all underwater anthropogenic sound sources, and reflects the best available science on the potential for noise to affect auditory sensitivity by:

- Dividing sound sources into two groups (*i.e.*, impulsive and non-impulsive) based on their potential to affect hearing sensitivity;

- Choosing metrics that best address the impacts of noise on hearing sensitivity, *i.e.*, sound pressure level (peak SPL) and sound exposure level (SEL) (also accounts for duration of exposure); and

- Dividing marine mammals into hearing groups and developing auditory weighting functions based on the science supporting that not all marine mammals hear and use sound in the same manner.

These thresholds were developed by compiling and synthesizing the best available science, and are provided in Table 4 below. The references, analysis, and methodology used in the development of the thresholds are described in NMFS 2018 Technical Guidance, which may be accessed at *https://www.fisheries.noaa.gov/national/marine-mammal-protection/marine-mammal-acoustic-technical-guidance*.

The City's pile driving and removal activity includes the use of impulsive (impact pile driving) and non-impulsive (vibratory pile driving and removal) sources.

Table 4. Thresholds identifying the onset of Permanent Threshold Shift (Auditory Injury).

	PTS Onset Acoustic Thresholds* (Received Level)	
Hearing Group	**Impulsive**	**Non-impulsive**
Low-Frequency (LF) Cetaceans	*Cell 1* $L_{pk,flat}$: 219 dB $L_{E,LF,24h}$: 183 dB	*Cell 2* $L_{E,LF,24h}$: 199 dB
Mid-Frequency (MF) Cetaceans	*Cell 3* $L_{pk,flat}$: 230 dB $L_{E,MF,24h}$: 185 dB	*Cell 4* $L_{E,MF,24h}$: 198 dB
High-Frequency (HF) Cetaceans	*Cell 5* $L_{pk,flat}$: 202 dB $L_{E,HF,24h}$: 155 dB	*Cell 6* $L_{E,HF,24h}$: 173 dB
Phocid Pinnipeds (PW) (Underwater)	*Cell 7* $L_{pk,flat}$: 218 dB $L_{E,PW,24h}$: 185 dB	*Cell 8* $L_{E,PW,24h}$: 201 dB

Otariid Pinnipeds (OW) (Underwater)	*Cell 9* $L_{pk,flat}$: 232 dB $L_{E,OW,24h}$: 203 dB	*Cell 10* $L_{E,OW,24h}$: 219 dB

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

Note: Peak sound pressure (L_{pk}) has a reference value of 1 μPa, and cumulative sound exposure level (L_E) has a reference value of 1μPa^{2}s. In this Table, thresholds are abbreviated to reflect American National Standards Institute standards (ANSI 2013). However, peak sound pressure is defined by ANSI as incorporating frequency weighting, which is not the intent for this Technical Guidance. Hence, the subscript "flat" is being included to indicate peak sound pressure should be flat weighted or unweighted within the generalized hearing range. The subscript associated with cumulative sound exposure level thresholds indicates the designated marine mammal auditory weighting function (LF, MF, and HF cetaceans, and PW and OW pinnipeds) and that the recommended accumulation period is 24 hours. The cumulative sound exposure level thresholds could be exceeded in a multitude of ways (*i.e.*, varying exposure levels and durations, duty cycle). When possible, it is valuable for action proponents to indicate the conditions under which these acoustic thresholds will be exceeded.

Ensonified Area

Here, we describe operational and environmental parameters of the activity that will feed into identifying the area ensonified above the acoustic thresholds, which include source levels and transmission loss coefficient.

Sound Propagation

Transmission loss (TL) is the decrease in acoustic intensity as an acoustic pressure wave propagates out from a source. TL parameters vary with frequency, temperature, sea conditions, current, source and receiver depth, water depth, water chemistry, and bottom composition and topography. The general formula for underwater TL is:

$TL = B * \log_{10}(R_1/R_2)$, where

B = transmission loss coefficient (assumed to be 15)

R_1 = the distance of the modeled SPL from the driven pile, and

R_2 = the distance from the driven pile of the initial measurement.

This formula neglects loss due to scattering and absorption, which is assumed to be zero here. The degree to which underwater sound propagates away from a sound source is dependent on a variety of factors, most notably the water bathymetry and presence or absence of reflective or absorptive conditions including in-water structures and sediments. Spherical spreading occurs in a perfectly unobstructed (free-field) environment not limited by depth or water surface, resulting in a 6 dB reduction in sound level for each doubling of distance from the source (20*log(range)). Cylindrical spreading occurs in an environment in which sound propagation is bounded by the water surface and sea bottom, resulting in a reduction of 3 dB in sound level for each doubling of distance from the source (10*log(range)). As is common practice in coastal waters, here we assume practical spreading loss (4.5 dB reduction in sound level for each doubling of distance). Practical spreading is a compromise that is often used under conditions where water depth increases as the receiver moves away from the shoreline, resulting in an expected propagation environment that would lie between spherical and cylindrical spreading loss conditions.

Sound Source Levels

The intensity of pile driving sounds is greatly influenced by factors such as the type of piles, hammers, and the physical environment in which the activity takes place. There are source level measurements available for certain pile types and sizes from the similar environments recorded from underwater pile driving projects (CALTRANS 2015) that were evaluated and used as proxy sound source levels to determine reasonable sound source levels likely result from the City's pile driving and removal activities (Table 5). Many source levels used were more conservation as the values were from larger pile sizes.

Table 5. Predicted Sound Source Levels.

Activity	Sound Source Level at 10 meters	Sound Source
Vibratory Pile Driving/Removal		

14-inch H pile steel pile temporary	155 SPL	CALTRANS 2015 (12-in H piles sound source value used, as no 14-in H pile sound source level is available)
36-inch steel pile permanent	170 SPL	CALTRANS 2015
Impact Pile Driving		
24-inch concrete pile permanent	166 SEL/176 SPL	CALTRANS 2015

Notes: These are unattentuated values, as the applicant proposes to use a bubble curtain for a 7dB reduction for impact driving.

Level A Harassment

When the NMFS Technical Guidance (2016) was published, in recognition of the fact that ensonified area/volume could be more technically challenging to predict because of the duration component in the new thresholds, we developed a User Spreadsheet that includes tools to help predict a simple isopleth that can be used in conjunction with marine mammal density or occurrence to help predict takes. We note that because of some of the assumptions included in the methods used for these tools, we anticipate that isopleths produced are typically going to be overestimates of some degree, which may result in some degree of overestimate of Level A harassment take. However, these tools offer the best way to predict appropriate isopleths when more sophisticated 3D modeling methods are not available, and NMFS continues to develop ways to quantitatively refine these tools, and will qualitatively address the output where appropriate. For stationary sources (such as from impact and vibratory pile driving), NMFS User Spreadsheet predicts the closest distance at which, if a marine mammal remained at that distance the whole duration of the activity, it would not incur PTS. Inputs used in the User Spreadsheet (Tables 6 and 7), and the resulting isopleths are reported below (Table 8).

Table 6. NMFS Technical Guidance (2018) User Spreadsheet Input to Calculate PTS Isopleths for Vibratory Pile Driving.

USER SPREADSHEET INPUT –Vibratory Pile Driving Spreadsheet Tab A.1 Vibratory Pile Driving Used.

	14-in H piles (temporary install/removal)	**36-in piles (permanent)**
Source Level (RMS SPL)	155	170
Weighting Factor Adjustment (kHz)	2.5	2.5
Number of piles within 24-hr period	6	2
Duration to drive a single pile (min)	4	30
Propagation (xLogR)	15	15
Distance of source level measurement (meters)+	10	10

Table 7. NMFS Technical Guidance (2018) User Spreadsheet Input to Calculate PTS Isopleths for Impact Pile Driving.

USER SPREADSHEET INPUT – Impact Pile Driving Spreadsheet Tab E.1 Impact Pile Driving Used.	
	24-in concrete piles (permanent)
Source Level (Single Strike/shot SEL)	159*
Weighting Factor Adjustment (kHz)	2
Number of strikes per pile	3100
Number of piles per day	1
Propagation (xLogR)	15
Distance of source level measurement (meters)+	10

*this includes the 7dB reduction from use of a bubble curtain.

Table 8. NMFS Technical Guidance (2018) User Spreadsheet Outputs to Calculate Level A Harassment PTS Isopleths.

USER SPREADSHEET OUTPUT		**PTS isopleths (meters)**				
		Level A harassment				
Activity	**Sound Source Level at 10 m**	**Low-Frequency Cetaceans**	**Mid-Frequency Cetaceans**	**High-Frequency Cetaceans**	**Phocid**	**Otariid**
Vibratory Pile Driving/Removal						
14-in H pile steel installation /removal	155 dB SPL	1.5	0.1	2.2	0.9	0.1
36-in steel permanent installation	170 dB SPL	13.1	1.2	19.3	7.9	0.6

Impact Pile Driving						
24-in concrete permanent installation	166 SEL/176 SPL (159 dB SEL as attenuated)	53.3	1.9	63.5	28.5	2.1

Level B Harassment

Utilizing the practical spreading loss model, the City determined underwater noise will fall below the behavioral effects threshold of 120 dB rms for marine mammals at the distances shown in Table 9 for vibratory pile driving/removal. For calculating the Level B Harassment Zone for impact driving, the practical spreading loss model was used with a behavioral threshold of 160 dB rms for marine mammals at the distances shown in Table 9 for impact pile driving. Table 9 below provides all Level B Harassment radial distances (m) and their corresponding areas (km^2) during the City's proposed activities.

Table 9. Radial Distances (meters) to Relevant Behavioral Isopleths and Associated Ensonified Areas (square kilometers (km^2)) Using the Practical Spreading Model.

Activity	Received Level at 10 m	Level B Harassment Zone (m)*	Level B Harassment Zone (km^2)
Vibratory Pile Driving/Removal			
14-inch H piles installation/removal	155 dB SPL	2,154	2.190
36-inch steel permanent installation	170 dB SPL	21,544	21.49
Impact Pile Driving			
24-inch concrete permanent installation	166 dB SEL/176 dB SPL (169 dB SPL attenuated)	39.8	0.004

Marine Mammal Occurrence and Take Calculation and Estimation

In this section we provide the information about the presence, density, or group dynamics of marine mammals that will inform the take calculations. Potential exposures to impact pile driving and vibratory pile driving/removal for each acoustic threshold were estimated using group size estimates and local observational data to create a density estimate. As previously stated, take by Level B harassment only will be considered for this action. Distances to Level A harassment thresholds are relatively small and mitigation is expected to avoid Level A harassment from these activities.

Gray whales

There are no density estimates of gray whales available in the project area. Gray whales travel alone or in small, unstable groups, although large aggregations may be seen in feeding and breeding grounds (NMFS 2018). Gray whales are uncommon in the San Francisco Bay. It is estimated that approximately 2–6 individuals enter the bay in a typical year (CALTRANS 2018). However nine gray whales have stranded in the San Francisco Bay in 2019 (Katz 2019). To be conservative, NMFS proposes to authorize seven instances of take by Level B harassment of gray whales. Because the required shutdown measures are larger than the associated Level A harassment zones, and those zones are relatively small (53.3 m at the largest during impact pile driving), and activities will occur over a small number of days, we believe the PSO will be able to effectively monitor the Level A harassment zones and we do not anticipate take by Level A harassment of gray whales.

Bottlenose dolphin

There are no density estimates of Bottlenose dolphin available in the project area. Individuals in the San Francisco Bay are typically sighted near the Golden Gate Bridge, where an average of five dolphins enter the bay approximately three times annually. Two individuals are sighted regularly near Alameda Point, outside of the Seaplane Lagoon (CALTRANS 2018). Low numbers (ranging from 1 to 5) of individually identified coastal bottlenose dolphins have been seen along the southwest side of Alameda Island since July 2016. Much of the time, the dolphins were close to the south side of the main outer breakwater that separates the bay from the lagoon areas. The last reliable sighting there was April 7, 2019 of a single individual (TMMC, B. Keener pers. comm. 2019). For the purpose of this assessment it is predicted that two bottlenose dolphins may occur in the San Francisco Bay in the Project vicinity on all pile driving days (*i.e.*, up to 48 individuals in 24 days. Therefore, NMFS proposes to authorize 48 instances of take of bottlenose dolphin by Level B harassment. The Level A harassment zones are all under 2 m for mid-frequency cetaceans; therefore, no take by Level A harassment is anticipated.

Harbor porpoise, Harbor seals, and California sea lions

In-water densities of harbor porpoises, harbor seals, California sea lions were calculated based on 17 years of observations during monitoring for the San Francisco Bay-Oakland Bay Bridge (SFOBB) construction and demolition project (Caltrans 2018). Care was taken to eliminate multiple observations of the same animal, although this can be difficult and is likely that the same individual may have been counted multiple times on the same day. The amount of monitoring performed per year varied, depending on the frequency and duration of construction activities with the potential to affect marine mammals. During the 257 days of monitoring from 2000 through 2017 (including 15 days of baseline monitoring in 2003), 1,029 harbor seals, 83 California sea lions, and 24 harbor porpoises were observed in waters in the project vicinity in total. In 2015, 2016, and 2017, the number of harbor seals in the project area increased significantly. A California sea lion density estimate of 0.161 animals/km^2 was calculated using the data from 2000-2017. In 2017, the number of harbor porpoise in the project area also increased significantly. Therefore, a harbor seal density estimate of 3.957 animals/km^2 was calculated using the 2015–2017 data. A harbor porpoise density estimate of 0.167 animals/km^2

was calculated using the 2017 data, which may better reflect the current use of the project area by these animals. These observations included data from baseline, pre-, during, and post-pile driving, mechanical dismantling, on-shore blasting, and off-shore implosion activities.

In addition to the information provided above regarding harbor seal density estimates, harbor seals are known to use the tip of Breakwater Island, which is located approximately 1.0 mi southwest of the project area, as a haul-out site. These seals forage in the project area as well (WETA 2011). In recent years, up to 32 harbor seals have been observed making irregular use of the Breakwater Island haul-out (AECOM 2017). The City of Alameda has also recently installed a haul-out platform approximately 0.5 mi southeast of the site. Although these locations are not considered primary haul-outs for harbor seals due to the relatively low numbers of individuals that are present, Breakwater Island and the City haul-out platform are reportedly the only haul-out sites in the central Bay that are accessible to seals throughout the full tidal range.

A local group of Alameda Point Harbor Seal Monitors regularly counts the number of harbor seals at Alameda Point, and based on count data from 2014 to 2019 an average of 11.7 harbor seals is present at Alameda Point year-round (Bangert pers. comm. 2019 in the application). However, the numbers of harbor seals present in the area varies considerably with season, with higher numbers in the winter due to the presence of spawning Pacific herring (*Clupea pallasii*) in the San Francisco Bay. Project pile driving activities will occur during the months of August and September, and therefore we estimated the average number of harbor seals based on count data these months only. The data summary indicated that the numbers of harbor seals present at Alameda increased in 2017 and 2018 compared to 2015 and 2016, and therefore only count data from 2017 and 2018 was used to ensure that the density estimate reflects current conditions. The average number of harbor seals counted at Alameda Point in August and

September of 2017 and 2018 was 6.5 individuals. These densities described above for harbor porpoise, harbor seals, and California sea lions are then used to calculate estimated take and described in the sub-sections below for these species.

Harbor porpoise

A predicted density of 0.167 animals/km^2 based for harbor porpoise was used to estimate take (Table 10). The estimated take was calculated using this density multiplied by the area ensonified above the threshold multiplied by the number of days per activity (*e.g.*, 6 days of impact pile driving) (Table 10). Therefore, a total of 26 instances of take by Level B harassment are proposed for harbor porpoise. Because the required shutdown measures are larger than the associated Level A harassment zones, and the harassment zones ar not very larger (63.5 m at the largest during impact pile driving), and will only occur over a small number of days, we believe the PSO can effectively monitor the Level A harassment zones and therefore we do not anticipate take by Level A harassment of harbor porpoise.

Table 10. Proposed Estimated Take by Level B Harassment of Harbor Porpoise.

Source	**Density (animals/km^2)**	**Area (km^2)**	**Days of Activity**	**Proposed Level B take by harassment**
Vibratory Installation and Removal 14-in H piles	0.167	2.190	12	4.389
Vibratory 36-in piles	0.167	21.490	6	21.533
Impact 24-in piles	0.167	0.004	6	0.004
Total Take by Level B harassment				25.926 (rounded to 26)

Harbor Seal

A predicted a density of 3.957 animals/km^2 for harbor seals was used to estimate take by Level B harassment (Table 11). This density should account for harbor seals exposed in the water while moving to and from the breakwater haul out since those animals would be in the bay and accounted for by the density estimate. The estimated take was calculated using this density multiplied by the area ensonified above the threshold multiplied by the number of days per activity (*e.g.*, 6 days of impact pile driving) (Table 11). Therefore, a total of 615 instances of take by Level B harassment are proposed for harbor seals. Because the required shutdown measures are larger than the associated Level A harassment zones, and those zones are relatively small (28.5 m at the largest during impact pile driving), we believe the PSO can effectively monitor the Level A harassment zones and therefore we do not anticipate any take by Level A harassment of harbor seals.

Table 11. Proposed Estimated Take by Level B Harassment of Harbor Seal.

Source	**Density (animals/km^2)**	**Area (km^2)**	**Days of Activity**	**Proposed Level B take by harassment**
Vibratory Installation and Removal 14-in H piles	3.957	2.190	12	103.999
Vibratory 36-in piles	3.957	21.490	6	510.216
Impact 24-in piles	3.957	0.004	6	0.095
Total Take by Level B harassment				614.31 (rounded to 615)

California sea lions

A predicted a density of 0.161 animals/km^2 based for California sea lions was used to estimate take by Level B harassment (Table 12). The estimated take was calculated using this density multiplied by the area ensonified above the threshold multiplied by the number of days per activity (*e.g.*, 6 days of impact pile driving) (Table 12). Therefore, a total of 25 instances of take by Level B harassment are proposed for California sea lions. The Level A harassment zones are all under 2.1 m for otariids; therefore, no take by Level A harassment of California sea lions is anticipated.

Table 12. Proposed Estimated Take by Level B Harassment of California sea lions.

Source	**Density (animals/km^2)**	**Area (km^2)**	**Days of Activity**	**Proposed Level B take by harassment**
Vibratory Installation and Removal 14-in H piles	0.161	2.190	12	4.231
Vibratory 36-in piles	0.161	21.490	6	20.759
Impact 24-in piles	0.161	0.004	6	0.004
Total Take by Level B harassment				**24.994 (rounded to 25)**

Northern elephant seal

There are no density estimates of northern elephant seals available in the project area. Elephant seals breed between December and March and have been rarely cited in San Francisco Bay. It is anticipated that if an elephant seal is encountered at all during pile driving or drilling it would be a juvenile. For the purpose of this assessment, we predict that up to one northern elephant seal may occur in the San Francisco Bay in the Project vicinity on up to 20 percent of pile driving days (*i.e.*, up to 4.8 individuals in 24 days). This assumption is consistent with the recent IHA for the demolition and reuse of the marine foundations of the original east span of the San Francisco-Oakland Bay Bridge (CALTRANS 2018). Therefore, NMFS proposes to authorize five takes (0.2 seals/day multiplied by 24 project days) by Level B harassment of elephant seals. Because the required shutdown measures are larger than the associated Level A harassment zones, and those zones are relatively small (28.5 m at the largest during impact pile driving), we believe the PSO can effectively monitor the Level A harassment zones and therefore we do not anticipate any take by Level A harassment of northern elephant seals.

Northern fur seals

There are no density estimates of northern fur seals available in the project area. The Marine Mammal Center (TMMC) reported only two to four northern fur seal strandings in the Bay in 2015 and 2016 (in Marin, San Francisco, and Santa Clara counties) (TMMC 2017). To account for the possible rare presence of the species in the action area, NMFS proposes to authorize three takes by Level B harassment of northern fur seals. The Level A harassment zones are all under 2.1 m for otariids; therefore, no take by Level A harassment of Northern fur seals is anticipated.

Table 13 below summarizes the proposed estimated take for all the species described above as a percentage of stock abundance.

Table 13. Proposed Take Estimates as a Percentage of Stock Abundance.

Species	Stock (N_{EST})	Level A Harassment	Level B Harassment	Percent of Stock
Gray Whale	Eastern North Pacific (26,960)	0	7	Less than 1 percent
Bottlenose Dolphin	California Coastal (453)	0	48	10.596 percent
Harbor Porpoise	San Francisco-Russian River (9,886)	0	27	Less than one percent
Harbor Seal	California (30,968)	0	615	Less than 2 percent
Northern Elephant Seal	California Breeding (179,000)	0	5	Less than one percent
California Sea	U.S. (257,606)	0	25	Less

Lion				than one percent
Northern fur seal	Eastern DPS, California (20,000)	0	3	Less than one percent

Proposed Mitigation

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

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

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

2) the practicability of the measures for applicant implementation, which may consider such things as cost, impact on operations, and, in the case of a military readiness activity, personnel safety, practicality of implementation, and impact on the effectiveness of the military readiness activity.

The following mitigation measures are proposed in the IHA:

Timing Restrictions

All work will be conducted during daylight hours. If poor environmental conditions restrict visibility full visibility of the shutdown zone, pile installation would be delayed.

Sound Attenuation

To minimize noise during impact pile driving, a 12-inch thick wood cushion block will be used. Bubble curtains will be also used during any impact pile driving of piles located in the water. The bubble curtain will be operated in a manner consistent with the following performance standards:

a. The bubble curtain will distribute air bubbles around 100 percent of the piling perimeter for the full depth of the water column;

b. The lowest bubble ring will be in contact with the mudline for the full circumference of the ring, and the weights attached to the bottom ring shall ensure 100 percent mudline contact. No parts of the ring or other objects shall prevent full mudline contact; and

c. Air flow to the bubblers must be balanced around the circumference of the pile.

Soft start

Soft start requires contractors to provide an initial set of strikes at reduced energy, followed by a thirty-second waiting period, then two subsequent reduced energy strike sets. A soft start must be implemented at the start of each day's impact pile driving and at any time following cessation of impact pile driving for a period of thirty minutes or longer.

Shutdown Zone for in-water Heavy Machinery Work

For in-water heavy machinery work other than pile driving, if a marine mammal comes within 10 m of such operations, operations shall cease and vessels shall reduce speed to the minimum level required to maintain steerage and safe working conditions.

Shutdown Zones

For all pile driving/removal and drilling activities, the City will establish shutdown zones for a marine mammal species that is greater than its corresponding Level A harassment zone. The calculated PTS isopleths were rounded up to a whole number to determine the actual shutdown zones that the applicant will operate under (Table 14). The purpose of a shutdown zone is generally to define an area within which shutdown of the activity would occur upon sighting of a marine mammal (or in anticipation of an animal entering the defined area).

Table 14. Pile Driving Shutdown Zones during Project Activities.

Activity	Shutdown Zones (radial distance in meters, area in km^{2*})				
	Low-Frequency Cetaceans	Mid-Frequency Cetaceans	High-Frequency Cetaceans	Phocid	Otariid
In-Water Construction Activities					
Heavy machinery work (other than pile driving)	10 (0.00015 km^2)	10 (0.00015 km^2)	10 (0.00015 km^2)	10 (0.00015 km^2)	10 (0.00015 km^2)
Vibratory Pile Driving/Removal					
14-in H pile steel installation /removal	10 (0.00015 km^2	10 (0.00015 km^2	10 (0.00015 km^2	10 (0.00015 km^2	10 (0.00015 km^2
36-in steel permanent installation	15 (0.00035 km^2)	10 (0.00015 km^2)	20 (0.00063 km^2)	10 (0.00015 km^2)	10 (0.00015 km^2)
Impact Pile Driving					

24-in concrete permanent installation	55 (0.00475 km^2)	10 (0.00015 km^2)	65 (0.00663 km^2)	30 (0.00141 km^2)	10 (0.00015 km^2)

*Note: km^2 were divided by two to account for land.

Non-authorized Take Prohibited

If a species enters or approaches the Level B zone and that species is either not authorized for take or its authorized takes are met, pile driving and removal activities must shut down immediately using delay and shut-down procedures. Activities must not resume until the animal has been confirmed to have left the area or an observation time period of 15 minutes has elapsed for pinnipeds and small cetaceans and 30 minutes for large whales.

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

Proposed Monitoring and Reporting

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

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

- Occurrence of marine mammal species or stocks in the area in which take is anticipated (*e.g.*, presence, abundance, distribution, density);
- Nature, scope, or context of likely marine mammal exposure to potential stressors/impacts (individual or cumulative, acute or chronic), through better understanding of: (1) action or environment (*e.g.*, source characterization, propagation, ambient noise); (2) affected species (*e.g.*, life history, dive patterns); (3) co-occurrence of marine mammal species with the action; or (4) biological or behavioral context of exposure (*e.g.*, age, calving or feeding areas);
- Individual marine mammal responses (behavioral or physiological) to acoustic stressors (acute, chronic, or cumulative), other stressors, or cumulative impacts from multiple stressors;
- How anticipated responses to stressors impact either: (1) long-term fitness and survival of individual marine mammals; or (2) populations, species, or stocks;
- Effects on marine mammal habitat (*e.g.*, marine mammal prey species, acoustic habitat, or other important physical components of marine mammal habitat); and
- Mitigation and monitoring effectiveness.

Pre-Activity Monitoring

Prior to the start of daily in-water construction activity, or whenever a break in pile driving of 30 min or longer occurs, PSOs will observe the shutdown and monitoring zones for a period of 30 min. The shutdown zone will be cleared when a marine mammal has not been observed within the zone for that 30-min period. If a marine mammal is observed within the shutdown zone, pile driving activities will not begin until the animal has left the shutdown zone or has not been observed for 15 min. If the Level B Harassment Monitoring Zone has been observed for 30 min and no marine mammals (for which take has not been authorized) are present within the zone, work can continue even if visibility becomes impaired within the Monitoring Zone. When a marine mammal permitted for Level B harassment take has been permitted is present in the Monitoring zone, piling activities may begin and Level B harassment take will be recorded.

Monitoring Zones

The City will establish and observe monitoring zones for Level B harassment as presented in Table 9. The monitoring zones for this project are areas where SPLs are equal to or exceed 120 dB rms (for vibratory pile driving/removal) and 160 dB rms (for impact pile driving). These zones provide utility for monitoring conducted for mitigation purposes (*i.e.*, shutdown zone monitoring) by establishing monitoring protocols for areas adjacent to the shutdown zones. Monitoring of the Level B harassment zones enables observers to be aware of and communicate the presence of marine mammals in the project area, but outside the shutdown zone, and thus prepare for potential shutdowns of activity.

Visual Monitoring

Monitoring would be conducted 30 minutes before, during, and 30 minutes after all pile driving/removal and socking/rock anchoring activities. In addition, PSO shall record all incidents of marine mammal occurrence, regardless of distance from activity, and shall document any behavioral reactions in concert with distance from piles being driven/removed. Pile driving/removal activities include the time to install, remove a single pile or series of piles, as long as the time elapsed between uses of the pile driving equipment is no more than thirty minutes.

Monitoring will be conducted by PSOs from on land. The number of PSOs will vary from one to two, depending on the type of pile driving, method of pile driving and size of pile, all of which determines the size of the harassment zones. Monitoring locations will be selected to provide an unobstructed view of all water within the shutdown zone and as much of the Level B harassment zone as possible for pile driving activities. A single monitor will be present during impact pile driving, when impacts of the project will be limited to the area within the Alameda Lagoon, and two monitors will be present during vibratory pile driving when project impacts will extend into the waters of the San Francisco Bay.

In addition, PSOs will work in shifts lasting no longer than 4 hours with at least a 1-hour break between shifts, and will not perform duties as a PSO for more than 12 hours in a 24- hour period (to reduce PSO fatigue).

Monitoring of pile driving shall be conducted by qualified, NMFS-approved PSOs, who shall have no other assigned tasks during monitoring periods. The City shall adhere to the following conditions when selecting PSOs:

- Independent PSOs shall be used (*i.e.*, not construction personnel);
- At least one PSO must have prior experience working as a marine mammal observer during construction activities;
- Other PSOs may substitute education (degree in biological science or related field) or training for experience;
- Where a team of three or more PSOs are required, a lead observer or monitoring coordinator shall be designated. The lead observer must have prior experience working as a marine mammal observer during construction; and

- The City shall submit PSO CVs for approval by NMFS for all observers prior to monitoring.

The City shall ensure that the PSOs have the following additional qualifications:

- 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; use of binoculars may be necessary to correctly identify the target;
- Experience and ability to conduct field observations and collect data according to assigned protocols;
- Experience or training in the field identification of marine mammals, including the identification of behaviors;
- Sufficient training, orientation, or experience with the construction operation to provide for personal safety during observations;
- Writing skills sufficient to prepare a report of observations including but not limited to the number and species of marine mammals observed; dates and times when in-water construction activities were conducted; dates, times, and reason for implementation of mitigation (or why mitigation was not implemented when required); and marine mammal behavior;
- Ability to communicate orally, by radio or in person, with project personnel to provide real-time information on marine mammals observed in the area as necessary; and
- Sufficient training, orientation, or experience with the construction operations to provide for personal safety during observations.

Acoustic Monitoring

The City has developed a sound attenuation monitoring plan to protect fish and marine mammals during pile driving activities (see Appendix B of the application for further details). The acoustic monitoring will include documentation of the following, at a minimum:

- Hydrophone equipment and methods: recording device, sampling rate, distance from the pile where recordings were made; and depth of recording device(s);
- Type of pile being driven and method of driving during recordings; and
- Mean, medium, and maximum sound levels (dB re: 1µPa): cumulative sound exposure level, peak sound pressure level, rms sound pressure level, and single-strike sound exposure level.

Reporting of injured or dead marine mammals

In the unanticipated event that the planned activity clearly causes the take of a marine mammal in a manner prohibited by the IHA, such as serious injury, or mortality, the City must immediately cease the specified activities and report the incident to the NMFS Office of Protected Resources and the West Coast Region Stranding Coordinator. The report must include the following information:

- Time and date of the incident;
- Description of the incident;
- Environmental conditions (*e.g.*, wind speed and direction, Beaufort sea state, cloud cover, and visibility);
- Description of all marine mammal observations and active sound source use in the 24 hours preceding the incident;
- Species identification or description of the animal(s) involved;
- Fate of the animal(s); and

- Photographs or video footage of the animal(s).

Activities must not resume until NMFS is able to review the circumstances of the prohibited take. NMFS will work with the City to determine what measures are necessary to minimize the likelihood of further prohibited take and ensure MMPA compliance. The City may not resume their activities until notified by NMFS.

In the event the City discovers an injured or dead marine mammal, and the lead observer determines that the cause of the injury or death is unknown and the death is relatively recent (*e.g.*, in less than a moderate state of decomposition), the City must immediately report the incident to the Office of Protected Resources, NMFS, and the West Coast Region Stranding Coordinator, NMFS. The report must include the same information as the bullets described above. Activities may continue while NMFS reviews the circumstances of the incident. NMFS will work with the City to determine whether additional mitigation measures or modifications to the activities are appropriate.

In the event that the City discovers an injured or dead marine mammal, and the lead observer determines that the injury or death is not associated with or related to the specified activities (*e.g.*, previously wounded animal, carcass with moderate to advanced decomposition, or scavenger damage), the City must report the incident to the Office of Protected Resources, NMFS, and the West Coast Region Stranding Coordinator, NMFS, within 24 hours of the discovery.

Final report

The City shall submit a draft report to NMFS no later than 90 days following the end of construction activities or 60 days prior to the issuance of any subsequent IHA for the project.

The City shall provide a final report within 30 days following resolution of NMFS' comments on the draft report. Reports shall contain, at minimum, the following:

- Date and time that monitored activity begins and ends for each day conducted (monitoring period);
- Construction activities occurring during each daily observation period, including how many and what type of piles driven;
- Deviation from initial proposal in pile numbers, pile types, average driving times, etc.;
- Weather parameters in each monitoring period (*e.g.*, wind speed, percent cloud cover, visibility);
- Water conditions in each monitoring period (*e.g.*, sea state, tide state);
- For each marine mammal sighting:
  - Species, numbers, and, if possible, sex and age class of marine mammals;
  - Description of any observable marine mammal behavior patterns, including bearing and direction of travel and distance from pile driving activity;
  - Type of construction activity that was taking place at the time of sighting;
  - Location and distance from pile driving activities to marine mammals and distance from the marine mammals to the observation point;
  - If shutdown was implemented, behavioral reactions noted and if they occurred before or after shutdown.
  - Estimated amount of time that the animals remained in the Level A or B Harassment Zone.

▪ Description of implementation of mitigation measures within each monitoring period (*e.g.*, shutdown or delay);

▪ Other human activity in the area within each monitoring period;

▪ A summary of the following:

○ Total number of individuals of each species detected within the Level B Harassment Zone, and estimated as taken if correction factor appropriate;

○ Total number of individuals of each species detected within the Level A Harassment Zone and the average amount of time that they remained in that zone; and

○ Daily average number of individuals of each species (differentiated by month as appropriate) detected within the Level B Harassment Zone, and estimated as taken, if appropriate.

Negligible Impact Analysis and Determination

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

As stated in the proposed mitigation section, shutdown zones that are larger than the Level A harassment zones and are expected avoid the likelihood of Level A harassment for all seven species.

Exposures to elevated sound levels produced during pile driving activities may cause behavioral disturbance of marine mammals, but they are expected to be mild and temporary. Effects on individuals that are taken by Level B harassment, on the basis of reports in the literature as well as monitoring from other similar activities, will likely be limited to reactions such as increased swimming speeds, increased surfacing time, or decreased foraging (if such activity were occurring) (*e.g.*, Thorson and Reyff, 2006; Lerma, 2014). Most likely, individuals will simply move away from the sound source and be temporarily displaced from the areas of pile driving, although even this reaction has been observed primarily only in association with impact pile driving. These reactions and behavioral changes are expected to subside quickly when the exposures cease.

To minimize noise during pile driving, and thereby both the scale and potential severity of the anticipated effects, the City will use pile cushions and a bubble curtain during impact pile driving.

During all impact driving, implementation of soft start procedures and monitoring of established shutdown zones will be required, significantly reducing the possibility of injury.

Given sufficient notice through use of soft start (for impact driving), marine mammals are expected to move away from an irritating sound source prior to it becoming potentially injurious. In addition, PSOs will be stationed within the action area whenever pile driving/removal activities are underway. Depending on the activity, the City will employ one to two PSOs to ensure all monitoring and shutdown zones are properly observed.

Two known pinniped haul-out sites (non-pupping sites) are located in the vicinity of the project area. One is an existing haul out platform approximately 0.5 mi southeast of the project area (separated from project activities by approximately 0.3 mi of developed areas on-land). The second haul out is the western end of Breakwater Island, approximately 1.0 mi southwest of the location of pile driving activities (Figure 4 of the application). They are both well outside the PTS isopleths for pinnipeds and no Level A harassment is expected. Exposures to elevated sound levels produced during pile driving activities once the animals enter the water from the haul outs may cause behavioral responses by an animal, but they are expected to be mild and temporary and limited to Level B harassment,

The proposed activities would not result in permanent impacts to habitats used directly by marine mammals except the actual footprint of the project. The footprint of the project is small, and equal to the area the ferry associated pile placement. The installation of piles for the new pier will result in permanent impacts on 61 ft^2 of aquatic habitat. At best, the impact area, which is located in Seaplane Lagoon, provides marginal foraging habitat for marine mammals and fish. In addition, impacts to marine mammal prey species are expected to be minor and temporary. Overall, the area impacted by the project is very small compared to the available habitat in the bay. The most likely impact to prey will be temporary behavioral avoidance of the immediate area. During pile driving/removal activities, it is expected that fish and marine mammals would temporarily move to nearby locations and return to the area following cessation of in-water construction activities. Therefore, indirect effects on marine mammal prey during the construction are not expected to be substantial.

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

- No serious injury or mortality is anticipated;
- No Level A Harassment is anticipated or proposed for authorization;
- Minimal impacts to marine mammal habitat are expected;
- The action area is located and within an active marine commercial area;
- There are no rookeries, or other known areas or features of special significance for foraging or reproduction in the project area;
- Anticipated incidents of Level B harassment consist of, at worst, temporary modifications in behavior; and
- The required mitigation measures (*i.e.* shutdown zones and pile cushion, and bubble curtain) are expected to be effective in reducing the effects of the specified activity.

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

Small Numbers

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

The take of six marine mammal stocks proposed for authorization comprises less than two percent of the stock abundance, and less than 11 percent for bottlenose dolphins (California coastal).

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

Unmitigable Adverse Impact Analysis and Determination

There are no relevant subsistence uses of the affected marine mammal stocks or species implicated by this action.

Endangered Species Act (ESA)

Section 7(a)(2) of the Endangered Species Act of 1973 (ESA: 16 U.S.C. 1531 *et seq.*) requires that each Federal agency insure that any action it authorizes, funds, or carries out is not likely to jeopardize the continued existence of any endangered or threatened species or result in the destruction or adverse modification of designated critical habitat. No ESA listed species are proposed for take. Therefore, NMFS has determined consultation under the ESA is not required.

Proposed Authorization

As a result of these preliminary determinations, NMFS proposes to issue an IHA to the City for conducting for the proposed pile driving and removal activities for construction of the Alameda Seaplane Lagoon ferry terminal for one year, beginning August 2019, provided the previously mentioned mitigation, monitoring, and reporting requirements are incorporated. A draft of the proposed IHA can be found at *https://www.fisheries.noaa.gov/permit/incidental-take-authorizations-under-marine-mammal-protection-act*.

Request for Public Comments

We request comment on our analyses, the proposed authorization, and any other aspect of this Notice of Proposed IHA for the proposed pile driving and removal activities for construction of the ferry terminal. We also request comment on the potential for renewal of this proposed IHA as described in the paragraph below. Please include with your comments any supporting data or literature citations to help inform our final decision on the request for MMPA authorization.

- On a case-by-case basis, NMFS may issue a one-year IHA renewal with an additional 15 days for public comments when (1) another year of identical or nearly identical activities as described in the Specified Activities section of this notice is planned or (2) the activities as described in the Specified Activities section of this notice would not be completed by the time the IHA expires and a second IHA would allow for completion of the activities beyond that described in the Dates and Duration section of this notice, provided all of the following conditions are met. A request for renewal is received no later than 60 days prior to expiration of the current IHA.

- The request for renewal must include the following:

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

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

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

Dated: July 15, 2019.

Donna S. Wieting,

Director, Office of Protected Resources,

National Marine Fisheries Service.

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