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Taking and Importing Marine Mammals; Taking Marine Mammals Incidental to Replacement of the Elliott Bay Seawall in Seattle, Washington; Proposed Rule

DEPARTMENT OF COMMERCE

National Oceanic and Atmospheric Administration

50 CFR Part 218

[Docket No. 130325286–3286–01]

RIN 0648–BC69

Taking and Importing Marine Mammals; Taking Marine Mammals Incidental to Replacement of the Elliott Bay Seawall in Seattle, Washington

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

ACTION: Proposed rule; request for comments.

SUMMARY: NMFS has received a request from the Seattle Department of Transportation (SDOT), on behalf of the City of Seattle (City), for authorization to take marine mammals incidental to construction associated with the replacement of the Elliott Bay Seawall in Seattle, Washington, for the period September 2013 to September 2018. Pursuant to the Marine Mammal Protection Act (MMPA), NMFS is proposing regulations to govern that take and requests information, suggestions, and comments on these proposed regulations.

DATES: Comments and information must be received no later than May 13, 2013.

ADDRESSES: You may submit comments on this document, identified by 0648–BC69, by any of the following methods:

- *Electronic Submission:* Submit all electronic public comments via the Federal e-Rulemaking Portal *www.regulations.gov.* To submit comments via the e-Rulemaking Portal, first click the Submit a Comment icon, then enter 0648–BC69 in the keyword search. Locate the document you wish to comment on from the resulting list and click on the Submit a Comment icon on the right of that line.
- Hand delivery or mailing of comments via paper or disc should be addressed to P. Michael Payne, Chief, Permits and Conservation Division, Office of Protected Resources, National Marine Fisheries Service, 1315 East-West Highway, Silver Spring, MD 20910.

Comments regarding any aspect of the collection of information requirement contained in this proposed rule should be sent to NMFS via one of the means provided here and to the Office of Information and Regulatory Affairs, NEOB–10202, Office of Management and Budget, Attn: Desk Office, Washington, DC 20503, *OIRA@omb.eop.gov.*

Instructions: Comments must be submitted by one of the above methods to ensure that the comments are received, documented, and considered by NMFS. Comments sent by any other method, to any other address or individual, or received after the end of the comment period, may not be considered. All comments received are a part of the public record and will generally be posted for public viewing on *www.regulations.gov* without change. All personal identifying information (e.g., name, address) submitted voluntarily by the sender will be publicly accessible. Do not submit confidential business information, or otherwise sensitive or protected information. NMFS will accept anonymous comments (enter N/A in the required fields if you wish to remain anonymous). Attachments to electronic comments will be accepted in Microsoft Word, Excel, or Adobe PDF file formats only.

FOR FURTHER INFORMATION CONTACT: Michelle Magliocca, Office of Protected Resources, NMFS, (301) 427–8401.

SUPPLEMENTARY INFORMATION:

Availability

A copy of SDOT's application, and other supplemental documents, may be obtained by visiting the Internet at: *http://www.nmfs.noaa.gov/pr/permits/incidental.htm#applications.* Documents cited in this notice may also be viewed, by appointment, during regular business hours, at the aforementioned address.

Background

Sections 101(a)(5)(A) and (D) of the MMPA (16 U.S.C. 1361 *et seq.*) direct the Secretary of Commerce 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 authorization is 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), will not have an unmitigable adverse impact on the availability of the species or stock(s) for subsistence uses (where relevant), and if the permissible methods of taking and requirements pertaining to the mitigation, monitoring and reporting of such takings are set forth. NMFS has defined 'negligible impact' in 50 CFR 216.103 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.''

Except with respect to certain activities not pertinent here, 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''].''

Summary of Request

On September 17, 2012, NMFS received a complete application from SDOT requesting authorization for the take of nine marine mammal species incidental to replacement of the Elliott Bay Seawall in Seattle, Washington, over the course of 5 years. The purpose of the proposed project is to reduce the risks of coastal storm and seismic damage and to protect public safety, critical infrastructure, and associated economic activities in the area. Additionally, the project would improve the degraded ecosystem functions and processes of the Elliott Bay nearshore around the existing seawall. Noise produced during pile installation and removal activities has the potential to take marine mammals. SDOT requested, and NMFS is proposing, authorization to take nine marine mammal species by Level B harassment only: Pacific harbor seal (*Phoca vitulina*), California sea lion (*Zalophus californianus*), Steller sea lion (*Eumetopias jubatus*), harbor porpoise (*Phocoena phocoena*), Dall's porpoise (*Phocoenoides dalli*), southern resident and transient killer whales (*Orcinus orca*), humpback whale (*Megaptera novaengliae*), and gray whale (*Eschrichtius jubatus*). Injury or mortality is unlikely during the proposed project, and take by Level A harassment (including injury) or mortality is not requested nor proposed for authorization.

Description of the Specified Activity

SDOT proposes to replace the Elliott Bay Seawall from South Washington Street to Broad Street, along the Seattle waterfront abutting Elliott Bay in King County, Washington. The purpose of the project is to reduce the risks of coastal storm and seismic damages and to protect public safety, critical infrastructure, and associated economic activities along Seattle's central waterfront. Additionally, the project would improve nearshore ecosystem functions and processes in the vicinity of the existing seawall. The proposed project would be constructed in two phases: Phase 1 would extend for about 3,600 linear feet (ft) (1 kilometer (km)) from South Washington Street to Virginia Street, and Phase 2 would extend for about 3,500 linear ft (1 km) from Virginia to Broad Streets.

The new seawall would be constructed landward of the existing seawall face and result in a net setback of the wall from its existing location. The majority of seawall construction would occur behind a temporary steel sheet pile containment wall that would be placed waterward of the existing seawall complex and extend the full length of the construction work area during each construction season. The seawall structure would consist of a soil improvement structure that would stabilize the soils behind the existing seawall and may include anchors or tie-backs that extend down to non-liquefiable soil for seismic stability. A four-lane primary arterial that runs along the entire length of the seawall would need to be relocated during seawall construction. A stormwater treatment system would be installed to treat stormwater runoff from the project area using basic treatment technology to meet City code. Public amenities resulting from the project would include replaced railings, restoration of the Washington Street boat landing, riparian planters, street plantings, and reconstructed sidewalks.

Construction activities that may result in the take of marine mammals include in-water vibratory and impact pile installation and removal. An APE 200 or equivalent-type of vibratory hammer would be used, with no more than an APE 400 model required for a worst-case scenario. A Delmag D46–32 or equivalent-type of impact hammer would be used, with no more than a Delmag D62–22 required for a worst-case scenario. A total of 1,930 piles would be installed over a 5-year period, and 1,740 of those piles would also be removed (leaving 190 permanent piles). In addition, 80 existing piles would be removed over a 5-year period. All proposed in-water pile installation and removal is summarized in Tables 1 through 3 below. To account for potential mid-project changes in pile numbers, SDOT included a 10 percent contingency in their estimates for installation and removal. These contingency numbers are used in all calculations and assessments in this document. Roughly the same number and distribution of in-water steel sheet piles and permanent piles is expected for each year of the project. Piles installed in upland areas are not expected to result in the take of marine mammals because sound levels would not reach NMFS threshold criteria underwater and there are no pinniped haul-outs in the immediate area. Upland pile installation is not mentioned further.

Prior to excavation and demolition of the existing seawall, a temporary containment wall constructed of steel sheet piles would be installed in each construction segment (Table 1). The temporary containment wall would be installed by vibratory driving and would be located in the water about 5 ft (1.5 m) waterward of the existing seawall. It would remain in place throughout the duration of construction. After construction, the temporary containment wall would be removed with vibratory equipment. In the rare case where steel sheet piles would be load bearing, an impact hammer may be required to ''proof'' or set the piles. The temporary containment wall would serve to prevent adverse effects on nearshore marine habitat from the release of turbidity and contaminants associated with seawall excavation and demolition.

TABLE 1—TEMPORARY CONTAINMENT WALL INSTALLATION AND REMOVAL

[Steel sheet piles only]

Construction phase	Pile pairs [1] (10% contingency included)	Maximum duration (days)	Maximum hours per day	Installation/ removal method
Installation				
Phase 1 (Years 1–3)	1,023	60	12	vibratory.
Estimated number of piles that would require proofing [2]	205	[3] 4	10	impact.
Phase II (Years 4–5)	717	40	12	vibratory.
Estimated number of piles that would require proofing [2]	143	[3] 4	10	impact.
Removal				
Phase I	1,023	25	12	vibratory.
Phase II	717	15	12	vibratory.
Total Installed/Removed	1,740			

[1] Steel sheet pile pairs only (48 inches wide).
[2] Number equals 20 percent of estimated number of piles installed per phase.
[3] Total estimated installation time is 8 hours of actual impact driving.
[4] Total estimated installation time is 12 hours of actual impact driving.

Existing creosote-treated timber piles and concrete piles located waterward of the existing seawall face that would interfere with construction would be removed using a vibratory extraction method (Table 2). Timber pilings that break during extraction would be cut off 2 ft (0.6 m) below the mudline.

TABLE 2—EXISTING PILE REMOVAL

[Timber and concrete piles only]

Construction phase	Piles[1]	Pile type	Justification for removal	Maximum duration (days)	Maximum hours per day	Removal method
Phase 1 (Excluding Washington Street Boat Landing).	20	Creosote-treated timber[2].	Currently not used; from previous uses along wall.	2	12	vibratory.
Phase I (Washington Street Boat Landing Only).	8	Creosote-treated timber[2].	Support existing pier structure.	1	12	vibratory.
Phase II	49	Creosote-treated timber[2].	Currently not used; from previous uses along wall.	2	12	vibratory.
Phase II	3	Concrete[3]	Currently not used; from previous uses along wall.	1	12	vibratory.
Total Removed	80			6		

[1] Number includes 10 percent contingency.
[2] Assumed to be 14-in diameter.
[3] Assumed to be 18-in diameter.

About 190 permanent concrete piles would be installed on either side of the temporary sheet pile containment wall using impact pile installation (Table 3). All in-water permanent piles are assumed to be 16.5-in-diameter (42-cm) precast concrete octagonal piles. The temporary sheet pile containment wall may serve as an attenuation device during impact pile installation to reduce sound levels by up to 10 decibels (dB). The concrete pilings installed landward of the temporary containment wall are intended to provide permanent structural support for cantilevered sidewalks and pier areas with high vehicle traffic. The remaining pilings installed waterward of the temporary containment wall would support the replacement of the Washington Street Boat Landing.

TABLE 3—PERMANENT PILE INSTALLATION

[16.5-in-diameter (42-cm) precast concrete octagonal piles only]

Construction phase	Piles	Justification for installation	Maximum duration (days)	Maximum hours per day	Installation method
Phase I (Excluding Washington Street Boat Landing).	92	To support sidewalk, viewing areas, and vehicular traffic access.	11	10	Impact.
Phase I (Washington Street Boat Landing Only).	15	To support new pier structure	2	10	Impact.
Phase II	83	To support sidewalk and viewing areas.	10	10	Impact.
Total Installed	190		23		

Dates and Duration of Specified Activity

Seawall construction is expected to occur in two phases: Phase 1, which includes the area of the Central Seawall, and Phase 2, which includes the area of the North Seawall (Table 4). Phase 1 includes three construction segments, and Phase 2 includes two construction segments; each segment represents 1 to 2 years of construction. Construction is scheduled to begin with Phase I work in fall 2013. The three segments of Phase 1 would be constructed over three construction seasons with two summer shutdown periods from Memorial Day weekend through Labor Day weekend to accommodate the primary tourist and business season. Phase 2 construction is expected to begin following completion of Phase 1 and would occur over two 2-year construction seasons with a summer shutdown period each year. SDOT's Letter of Authorization (LOA) request covers the construction period from 2013 to 2018, from the start of Phase 1, Segment 1 to the end of Phase 2, Segment 1. A request for another MMPA authorization may be submitted for any further construction.

TABLE 4—PROPOSED PROJECT CONSTRUCTION SCHEDULE

Phase	Segment	Duration
1 (Central Seawall)	I	Year 1 (Fall 2013–Spring 2014).
	II	Year 2 (Fall 2014–Spring 2015).
	III	Year 3 (Fall 2015–Spring 2016).
2 (North Seawall)	I	Years 4 and 5 (Fall 2016–Spring 2018).
	II	Years 6 and 7 (Fall 2018–Spring 2020).*

***Note:** Years 6 and 7 would not be covered under this LOA request because the MMPA limits incidental take authorizations to 5-year periods.

Specified Geographical Region

The Elliott Bay Seawall runs along the downtown Seattle waterfront in King County, Washington. SDOT's proposed project would occur between South Washington Street and Broad Street, which abut Elliott Bay, a 21-square kilometer (km^2) urban embayment in central Puget Sound. The inner bay receives fresh water from the Duwamish River and most of the stormwater runoff from 67 km^2 of highly developed land in metropolitan Seattle. This is an important industrial region and home to the Port of Seattle, which ranked as the nation's sixth busiest U.S. seaport in 2010.

The region of the specified activity (or ''area of potential effects,'' as described in SDOT's application) is the area in which elevated sound levels from pile-related activities could result in the take of marine mammals. This area includes the proposed construction zone, Elliott Bay, and a portion of Puget Sound. The construction zone extends for about 7,100 linear ft (2,165 m) along the Seattle shoreline and is mostly concentrated in upland areas. The area of in-water pile installation and removal activities would be restricted to the length of the seawall and waterward to within 15 ft (4.6 m) of the seawall face, and to depths less than 30 feet (9.1 m). SDOT calculated unattenuated and unobstructed vibratory pile installation (or removal) to propagate up to 2.5 miles (4 km) from the sound source with high enough sound levels to meet NMFS' acoustic threshold criteria for marine mammal harassment (see Sound Thresholds section below). SDOT expects that pile-related construction noise could extend throughout the nearshore and open water environments to just west of Alki Point and a limited distance into the East Waterway of the Lower Duwamish River (a highly industrialized waterway).

Brief Background on Sound

An understanding of the basic properties of underwater sound is necessary to comprehend many of the concepts and analyses presented in this document. A summary is included below.

Sound is a wave of pressure variations propagating through a medium (e.g., water). Pressure variations are created by compressing and relaxing the medium. Sound measurements can be expressed in two forms: intensity and pressure. Acoustic intensity is the average rate of energy transmitted through a unit area in a specified direction and is expressed in watts per square meter (W/m^2). Acoustic intensity is rarely measured directly, but rather from ratios of pressures; the standard reference pressure for underwater sound is 1 microPascal (μPa); for airborne sound, the standard reference pressure is 20 μPa (Richardson *et al.,* 1995).

Acousticians have adopted a logarithmic scale for sound intensities, which is denoted in decibels (dB). Decibel measurements represent the ratio between a measured pressure value and a reference pressure value (in this case 1 μPa or, for airborne sound, 20 μPa). The logarithmic nature of the scale means that each 10-dB increase is a ten-fold increase in acoustic power (and a 20-dB increase is then a 100-fold increase in power; and a 30-dB increase is a 1,000-fold increase in power). A ten-fold increase in acoustic power does not mean that the sound is perceived as being ten times louder, however. Humans perceive a 10-dB increase in sound level as a doubling of loudness, and a 10-dB decrease in sound level as a halving of loudness. The term ''sound pressure level'' implies a decibel measure and a reference pressure that is used as the denominator of the ratio. Throughout this document, NMFS uses 1 microPascal (denoted re: 1μPa) as a standard reference pressure unless noted otherwise.

It is important to note that decibel values underwater and decibel values in air are not the same (different reference pressures and densities/sound speeds between media) and should not be directly compared. Because of the different densities of air and water and the different decibel standards (i.e., reference pressures) in air and water, a sound with the same level in air and in water would be approximately 62 dB lower in air. Thus, a sound that measures 160 dB (re 1 μPa) underwater would have the same approximate effective level as a sound that is 98 dB (re 20 μPa) in air.

Sound frequency is measured in cycles per second, or Hertz (abbreviated Hz), and is analogous to musical pitch; high-pitched sounds contain high frequencies and low-pitched sounds contain low frequencies. Natural sounds in the ocean span a huge range of frequencies: from earthquake noise at 5 Hz to harbor porpoise clicks at 150,000 Hz (150 kHz). These sounds are so low or so high in pitch that humans cannot even hear them; acousticians call these infrasonic (typically below 20 Hz) and ultrasonic (typically above 20,000 Hz) sounds, respectively. A single sound may be made up of many different frequencies together. Sounds made up of only a small range of frequencies are called ''narrowband'', and sounds with a broad range of frequencies are called ''broadband''; explosives are an example of a broadband sound source and active tactical sonars are an example of a narrowband sound source.

When considering the influence of various kinds of sound on the marine environment, it is necessary to understand that different kinds of marine life are sensitive to different frequencies of sound. Based on available behavioral data, audiograms derived using behavioral protocols or auditory evoked potential (AEP) techniques, anatomical modeling, and other data, Southall *et al.* (2007) designate ''functional hearing groups'' for marine mammals and estimate the lower and upper frequencies of functional hearing of the groups. Further, the frequency range in which each group's hearing is estimated as being most sensitive is represented in the flat part of the M-weighting functions (which are derived from the audiograms described above; see Figure 1 in Southall *et al.,* 2007) developed for each broad group. The functional groups and the associated frequencies are indicated below (though, again, animals are less sensitive to sounds at the outer edge of their functional range and most sensitive to sounds of frequencies within a smaller range somewhere in the middle of their functional hearing range):

- Low-frequency cetaceans—functional hearing is estimated to occur between approximately 7 Hz and 30 kHz;
- Mid-frequency cetaceans—functional hearing is estimated to occur between approximately 150 Hz and 160 kHz;
- High-frequency cetaceans—functional hearing is estimated to occur between approximately 200 Hz and 180 kHz;
- Pinnipeds in water—functional hearing is estimated to occur between approximately 75 Hz and 75 kHz.

The estimated hearing range for low-frequency cetaceans has been extended slightly from previous analyses (from 22 to 30 kHz). This decision is based on data from Watkins *et al.* (1986) for numerous mysticete species, Au *et al.* (2006) for humpback whales, an abstract from Frankel (2005) and paper from Lucifredi and Stein (2007) on gray whales, and an unpublished report (Ketten and Mountain, 2009) and abstract (Tubelli *et al.,* 2012) for minke whales. As more data from more species and/or individuals become available, these estimated hearing ranges may require modification.

When sound travels (propagates) from its source, its loudness decreases as the distance traveled by the sound increases. Thus, the loudness of a sound at its source is higher than the loudness of that same sound a kilometer away. Acousticians often refer to the loudness of a sound at its source (typically referenced to one meter from the source) as the source level and the loudness of sound elsewhere as the received level (i.e., typically the receiver). For example, a humpback whale 3 km from a device that has a source level of 230 dB may only be exposed to sound that is 160 dB loud, depending on how the sound travels through water (e.g., spherical spreading [3 dB reduction with doubling of distance] was used in this example). As a result, it is important to understand the difference between source levels and received levels when discussing the loudness of sound in the ocean or its impacts on the marine environment.

As sound travels from a source, its propagation in water is influenced by various physical characteristics, including water temperature, depth, salinity, and surface and bottom properties that cause refraction, reflection, absorption, and scattering of sound waves. Oceans are not homogeneous and the contribution of each of these individual factors is extremely complex and interrelated. The physical characteristics that determine the sound's speed through the water will change with depth, season, geographic location, and with time of day (as a result, in actual active sonar operations, crews will measure oceanic conditions, such as sea water temperature and depth, to calibrate models that determine the path the sonar signal will take as it travels through the ocean and how strong the sound signal will be at a given range along a particular transmission path). As sound travels through the ocean, the intensity associated with the wavefront diminishes, or attenuates. This decrease in intensity is referred to as propagation loss, also commonly called transmission loss.

Metrics Used in This Document

This section includes a brief explanation of the two sound measurements (sound pressure level (SPL) and sound exposure level (SEL)) frequently used to describe sound levels in the discussions of acoustic effects in this document.

Sound pressure level (SPL)—Sound pressure is the sound force per unit area, and is usually measured in micropascals (μPa), where 1 Pa is the pressure resulting from a force of one newton exerted over an area of one square meter. SPL is expressed as the ratio of a measured sound pressure and a reference level.

SPL (in dB) = 20 log (pressure/reference pressure)

The commonly used reference pressure level in underwater acoustics is 1 μPa, and the units for SPLs are dB re: 1 μPa. SPL is an instantaneous pressure measurement and can be expressed as the peak, the peak-peak, or the root mean square (rms). Root mean square pressure, which is the square root of the arithmetic average of the squared instantaneous pressure values, is typically used in discussions of the effects of sounds on vertebrates and all references to SPL in this document refer to the root mean square. SPL does not take the duration of exposure into account.

Sound exposure level (SEL)—SEL is an energy metric that integrates the squared instantaneous sound pressure over a stated time interval. The units for SEL are dB re: 1 μPa^2-s. Below is a simplified formula for SEL.

SEL = SPL + 10log(duration in seconds)

Impact hammers operate by repeatedly dropping a heavy piston onto a pile to drive the pile into the substrate. Sound generated by impact hammers is characterized by rapid rise times and high peak levels, a potentially injurious combination (Hastings and Popper, 2005). Sound generated by impact pile driving is highly variable, based on site-specific conditions such as substrate, water depth, and current. Sound levels may also vary based on the size of the pile, the type of pile, and the energy of the hammer.

Vibratory hammers install piles by vibrating them and allowing the weight of the hammer to push them into the sediment. Vibratory hammers produce much less sound than impact hammers. Peak SPLs may be 180 dB or greater, but are generally 10 to 20 dB lower than SPLs generated during impact pile driving of the same-sized pile (Caltrans, 2009). Rise time is slower, reducing the probability and severity of injury (USFWS, 2009), and sound energy is distributed over a greater amount of time (Nedwell and Edwards, 2002; Carlson *et al.,* 2001). However, vibratory hammers cannot be used in all circumstances. In some substrates, the capacity of a vibratory hammer may be insufficient to drive the pile to load-bearing capacity or depth (Caltrans, 2009). Additionally, some vibrated piles must be 'proofed' (i.e., struck with an impact hammer) for several seconds to several minutes in order to verify the load-bearing capacity of the pile (WSDOT, 2008).

Impact and vibratory pile driving are the primary in-water construction activities associated with the project. The sounds produced by these activities fall into one of two sound types: pulsed and non-pulsed (defined in next paragraph). Impact pile driving produces pulsed sounds, while vibratory pile driving produces non-pulsed sounds. The distinction between these two general 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). Southall *et al.* (2007) provides an in-depth discussion of these concepts and a summary is provided here.

Pulsed sounds (e.g., explosions, gunshots, sonic booms, seismic pile driving pulses, and impact pile driving) are brief, broadband, atonal transients (ANSI, 1986; Harris, 1998) 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 decay period that may include a period of diminishing, oscillating maximal and minimal pressures. Pulsed sounds generally have an increased capacity to induce physical injury as compared with sounds that lack these features.

Non-pulsed sounds (which may be intermittent or continuous) can be tonal, broadband, or both. Some of these non-pulse sounds can be transient signals of short duration but without the essential properties of pulses (e.g., rapid rise time). Examples of non-pulse 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.

Sound Thresholds

Since 1997, NMFS has used generic sound exposure thresholds to determine when an activity in the ocean that produces sound might result in impacts to a marine mammal such that a take by harassment or injury might occur (NMFS, 2005b). To date, no studies have been conducted that examine impacts to marine mammals from pile driving sounds from which empirical sound thresholds have been established. Current NMFS practice regarding exposure of marine mammals to high levels of sound is that cetaceans and pinnipeds exposed to impulsive sounds of 180 and 190 dB rms or above, respectively, are considered to have been taken by Level A (i.e., injurious) harassment. Behavioral harassment

(Level B) is considered to have occurred when marine mammals are exposed to sounds at or above 160 dB rms for impulse sounds (e.g., impact pile driving) and 120 dB rms for non-pulsed sound (e.g., vibratory pile driving), but below injurious thresholds. However, due to ongoing anthropogenic noise around Elliott Bay, the ambient sound level is higher than 120 dB in this region. Based on underwater sound measurements performed by the Washington State Department of Transportation in 2011, and following NMFS Northwest Region and Northwest Fisheries Science Center's ''Guidance Document: Data Collection Methods to Characterize Underwater Background Sound Relevant to Marine Mammals in Coastal Nearshore Waters and Rivers of Washington and Oregon,'' we assume that the ambient sound level around the proposed project area is 123 dB (Laughlin, 2011). Therefore, 123 dB rms is used to estimate Level B harassment for non-pulsed sound (e.g., vibratory pile driving) in this instance. For airborne sound, pinniped disturbance from haul-outs has been documented at 100 dB (unweighted) for pinnipeds in general, and at 90 dB (unweighted) for harbor seals. NMFS uses these levels as guidelines to estimate when harassment may occur.

Distance to Sound Thresholds

The extent of project-generated sound both in and over water was calculated for the locations where pile driving would occur in Elliott Bay. In the absence of site-specific data, the practical spreading loss model was used for determining the extent of sound from a source (Davidson, 2004; Thomsen *et al.,* 2006). The model assumes a logarithmic coefficient of 15, which equates to sound energy decreasing by 4.5 dB with each doubling of distance from the source. To calculate the loss of sound energy from one distance to another, the following formula is used:

$$\text{Transmission Loss (dB)} = 15 \log(D_1/D_0)$$

D_1 is the distance from the source for which SPLs need to be known, and D_0 is the distance from the source for which SPLs are known (typically 10 m from the pile). This model also solves for the distance at which sound attenuates to various decibel levels (e.g., a threshold or background level). The following equation solves for distance:

$$D_1 = D_0 \times 10^{(TL/15)}$$

where TL stands for transmission loss (the difference in decibel levels between D_0 and D_1). For example, using the distance to an injury threshold (D_1), the area of effect is calculated as the area of a circle, πr^2, where r (radius) is the distance to the threshold or background. If a landform or other shadowing element interrupts the spread of sound within the threshold distance, then the area of effect truncates at the location of the shadowing element.

Sound levels are highly dependent on environmental site conditions. Therefore, published hydroacoustic monitoring data for projects with similar site conditions as the Elliott Bay Seawall project were considered (Caltrans, 2009 and WSDOT, 2011a). Based on these data and the noise attenuation practical spreading model, also used for pile driving activities done by the Washington State Department of Transportation and the Washington State Ferries, the sound attenuation distances summarized in Table 5 have been identified for in-water pile installation. Distance thresholds that account for each pile-related activity and pile type proposed for the Elliott Bay Seawall project are presented in Table 6.

TABLE 5—SUMMARY OF NEAR-SOURCE (10-M) UNATTENUATED SOUND PRESSURES FOR IN-WATER PILE INSTALLATION USING AN IMPACT HAMMER AND VIBRATORY DRIVER/EXTRACTOR

Pile type and approximate size	Method	Relative water depth (m)	Average sound pressure measured in dB	
			Peak	RMS
Creosote-treated 14-inch-diameter timber pile	Vibratory removal	15	164	150
16.5-inch-diameter precast concrete octagonal pile.	Impact	15	188	176
Steel sheet pile pair; 48-inches in length per pair.	Vibratory (installation and removal)	15	182	165
Steel sheet pile pair; 48-inches in length per pair.	Impact (installation proofing)	15	205	190

TABLE 6—CALCULATED DISTANCES TO THRESHOLD VALUES FOR PILE-RELATED ACTIVITIES

Harassment threshold	Distance to harassment for pinnipeds	Distance to harassment for cetaceans
24-inch Steel Sheet Pile (vibratory)		
Level A (180 and 190 dB)	0.2 m (0.7 ft)	1 m (3.3 ft).
Level B (123 dB)	6,276 m (3.9 mi)	6,276 m (3.9 mi).
24-inch Steel Sheet Pile (impact, unattenuated)		
Level A (180 and 190 dB)	10 m (33 ft)	46 m (152 ft).
Level B (160 dB)	1,000 m (3,280 ft)	1,000 m (3,280 ft).
24-inch Concrete Pile (impact, unattenuated)		
Level A (180 and 190 dB)	1 m (3.3 ft)	5 m (18 ft).
Level B (160 dB)	117 m (383 ft)	117 m (383 ft).

TABLE 6—CALCULATED DISTANCES TO THRESHOLD VALUES FOR PILE-RELATED ACTIVITIES—Continued

Harassment threshold	Distance to harassment for pinnipeds	Distance to harassment for cetaceans
24-inch Concrete Pile (impact, unattenuated)		
Level A (180 and 190 dB)	0.5 m (1.8 ft)	2.5 m (8.2 ft).
Level B (160 dB)	54 m (177 ft)	54 m (177 ft).

Most distances to Level A thresholds (for vibratory steel sheet pile and impact concrete pile installations) were calculated to be very close to the sound source. In other words, the only way a marine mammal could be injured by elevated noise levels from pile-related activities would be if the animal was located immediately adjacent to the pile being driven. However, longer distances to Level A thresholds were calculated for impact pile installation for steel sheet piles: 152 ft for cetaceans and 33 ft for pinnipeds. Proposed mitigation and monitoring measures (discussed later in this document) would make the potential for injury unlikely.

Description of Marine Mammals in the Area of the Specified Activity

Nine marine mammal species, including distinct population segments, have the potential to occur in the area of the specified activity (Table 7). All nine species have been observed in Puget Sound at certain periods of the year and are discussed in further detail below.

TABLE 7—MARINE MAMMAL SPECIES OR DISTINCT POPULATION SEGMENTS THAT COULD OCCUR IN THE PROPOSED PROJECT AREA

Common name	Scientific name	ESA status	MMPA status	Abundance	Population status	Likelihood of occurrence	Seasonality
Pinnipeds							
Pacific harbor seal	*Phoca vitulina*			n/a	unknown	Occasional	Year-round
California sea lion	*Zalophus californianus*			296,750		Occasional	August–April.
Steller sea lion	*Eumetopias jubatus*	Threatened	Depleted	58,334–72,223	increasing	Rare	August–April.
Cetaceans							
Harbor porpoise	*Phocoena phocoena*			unknown	unknown	Rare	Year-round.
Dall's porpoise	*Phocoenoides dalli*			42,000	unknown	Rare	Winter–Spring.
Southern resident killer whale DPS.	*Orcinus orca*	Endangered		86	unknown	Occasional	Year-round.
Transient killer whale	*Orcinus orca*			346	unknown	Rare	Year-round.
Humpback whale	*Megaptera novaengliae.*	Endangered	Depleted	2,043	increasing	Rare	February–June.
Gray whale	*Eschrichtius robustus*			18,000	increasing	Rare	January–September.

Harbor Seal

Species Description—Harbor seals, which are members of the Phocid family (true seals), inhabit coastal and estuarine waters and shoreline areas from Baja California, Mexico to western Alaska. For management purposes, differences in mean pupping date (i.e., birthing) (Temte, 1986), movement patterns (Jeffries, 1985; Brown, 1988), pollutant loads (Calambokidis *et al.,* 1985) and fishery interactions have led to the recognition of three separate harbor seal stocks along the west coast of the continental U.S. (Boveng, 1988). The three distinct stocks are: (1) Inland waters of Washington (including Hood Canal, Puget Sound, and the Strait of Juan de Fuca out to Cape Flattery), (2) outer coast of Oregon and Washington, and (3) California (Carretta *et al.* 2007b). The seals that could potentially be in the project area are from the inland waters of Washington stock.

The average weight for adult seals is about 180 lb (82 kg) and males are typically slightly larger than females. Male harbor seals weigh up to 245 lb (111 kg) and measure approximately 5 ft (1.5 m) in length. The basic color of harbor seals' coat is gray and mottled but highly variable, from dark with light color rings or spots to light with dark markings (NMFS, 2008c).

Status—In 1999, the mean count of harbor seals occurring in Washington's inland waters was 9,550 animals (Jeffries *et al.,* 2003). Radio-tagging studies conducted at six locations collected information on haulout patterns of harbor seals in 1991 and 1992, resulting in a correction factor of 1.53 to account for animals in the water that are missed during the aerial surveys (Huber *et al.,* 2001). Using this correction factor results in a population estimate of 14,612 for the Washington inland waters stock of harbor seals (Jeffries *et al.,* 2003). Although this abundance estimate represents the best scientific information available, per NMFS stock assessment policy it is not considered current because it is more than 8 years old. Between 1983 and 1996, the annual rate of increase for this stock was 6 percent (Jeffries *et al.,* 1997). The peak count occurred in 1996 and, based on a fitted generalized logistic model, the population is thought to be stable. Because there is no current estimate of minimum abundance, potential biological removal (PBR) cannot be calculated for this stock. Harbor seals are not considered to be depleted under the MMPA or listed as threatened or endangered under ESA.

Behavior and Ecology—Harbor seals are non-migratory with local movements associated with such factors as tides, weather, season, food availability, and reproduction (Scheffer and Slipp, 1944; Fisher, 1952; Bigg, 1969, 1981). They are not known to make extensive pelagic migrations, although some long distance movement of tagged animals in Alaska (174 km), and along the U.S. west coast (up to 550 km), have been recorded (Pitcher and McAllister, 1981; Brown and Mate, 1983; Herder, 1986). Harbor seals are coastal species, rarely found more than 12 mi (20 km) from shore, and frequently occupy bays, estuaries, and inlets (Baird, 2001). Individual seals have been observed several miles upstream in coastal rivers. Ideal harbor seal habitat includes haul-out sites, shelter during the breeding periods, and sufficient food (Bjorge, 2002).

Harbor seals haul out on rocks, reefs, beaches, and ice and feed in marine, estuarine, and occasionally fresh waters. Harbor seals display strong fidelity for haul-out sites (Pitcher and Calkins, 1979; Pitcher and McAllister, 1981), although human disturbance can affect haul-out choice (Harris *et al.,* 2003). Group sizes range from small numbers of animals on intertidal rocks to several thousand animals found seasonally in coastal estuaries. The harbor seal is the most commonly observed and widely distributed pinniped found in Washington (Jeffries *et al.,* 2000; ODFW, 2010). Harbor seals use hundreds of sites to rest or haul out along the coast and inland waters of Washington, including tidal sand bars and mudflats in estuaries, intertidal rocks and reefs, beaches, log booms, docks, and floats in all marine areas of the state.

The harbor seal is the only pinniped species that is found year-round and breeds in Washington waters (Jeffries *et al.,* 2000). Harbor seals mate at sea and females give birth during the spring and summer, although the pupping season varies by latitude. Pupping seasons vary by geographic region with pups born in the San Juan Islands and eastern bays of Puget Sound from June through August. Suckling harbor seal pups spend as much as forty percent of their time in the water (Bowen *et al.,* 1999).

Individuals occur along the Elliott Bay shoreline (WSDOT, 2004). There is one documented harbor seal haul-out area of less than 100 animals near Bainbridge Island, about six miles from the proposed region of activity and outside of the area of potential effects. The haul-out consists of intertidal rocks and reef areas around Blakely Rocks (Jeffries *et al.,* 2000).

Acoustics—In air, harbor seal males produce a variety of low-frequency (less than 4 kHz) vocalizations, including snorts, grunts, and growls. Male harbor seals produce communication sounds in the frequency range of 100–1,000 Hz (Richardson *et al.,* 1995). Pups make individually unique calls for mother recognition that contain multiple harmonics with main energy below 0.35 kHz (Bigg, 1981; Thomson and Richardson, 1995). Harbor seals hear nearly as well in air as underwater and have lower thresholds than California sea lions (Kastak and Schusterman, 1998). Kastak and Schusterman (1998) reported airborne low frequency (100 Hz) sound detection thresholds at 65 dB for harbor seals. In air, they hear frequencies from 0.25–30 kHz and are most sensitive from 6–16 kHz (Richardson, 1995; Terhune and Turnbull, 1995; Wolski *et al.,* 2003).

Adult males also produce underwater sounds during the breeding season that typically range from 0.25–4 kHz (duration range: 0.1 s to multiple seconds; Hanggi and Schusterman 1994). Hanggi and Schusterman (1994) found that there is individual variation in the dominant frequency range of sounds between different males, and Van Parijs *et al.* (2003) reported oceanic, regional, population, and site-specific variation that could be vocal dialects. In water, they hear frequencies from 1–75 kHz (Southall *et al.,* 2007) and can detect sound levels as weak as 60–85 dB within that band. They are most sensitive at frequencies below 50 kHz; above 60 kHz sensitivity rapidly decreases.

California Sea Lion

Species Description—California sea lions are members of the Otariid family (eared seals). The species, *Zalophus californianus,* includes three subspecies: *Z. c. wollebaeki* (in the Galapagos Islands), *Z. c. japonicus* (in Japan, but now thought to be extinct), and *Z. c. californianus* (found from southern Mexico to southwestern Canada; referred to here as the California sea lion) (Carretta *et al.,* 2007). The breeding areas of the California sea lion are on islands located in southern California, western Baja California, and the Gulf of California (Carretta *et al.,* 2007). These three geographic regions are used to separate this subspecies into three stocks: (1) The U.S. stock begins at the U.S./Mexico border and extends northward into Canada, (2) the Western Baja California stock extends from the U.S./Mexico border to the southern tip of the Baja California peninsula, and (3) the Gulf of California stock which includes the Gulf of California from the southern tip of the Baja California peninsula and across to the mainland and extends to southern Mexico (Lowry *et al.,* 1992).

The California sea lion is sexually dimorphic. Males may reach 1,000 lb (454 kg) and 8 ft (2.4 m) in length; females grow to 300 lb (136 kg) and 6 ft (1.8 m) in length. Their color ranges from chocolate brown in males to a lighter, golden brown in females. At around 5 years of age, males develop a bony bump on top of the skull called a sagittal crest. The crest is visible in the dog-like profile of male sea lion heads, and hair around the crest gets lighter with age.

Status—The entire population of California sea lions cannot be counted because all age and sex classes are not ashore at the same time. Therefore, pups are counted during the breeding season and the number of births is estimated from the pup count. The size of the population is then estimated from the number of births and the proportion of pups in the population. This most recently resulted in a population estimate of 296,750 animals. The PBR level for this stock is 9,200 sea lions per year. California sea lions are not considered to be depleted under the MMPA or listed as threatened or endangered under ESA.

Behavior and Ecology—During the summer, California sea lions breed on islands from the Gulf of California to the Channel Islands and seldom travel more than about 31 mi (50 km) from the islands (Bonnell *et al.,* 1983). The primary rookeries are located in the California Channel Islands (Le Boeuf and Bonnell, 1980; Bonnell and Dailey, 1993). Their distribution shifts to the northwest in fall and to the southeast during winter and spring, probably in response to changes in prey availability (Bonnell and Ford, 1987).

The non-breeding distribution extends from Baja California north to Alaska for males, and encompasses the waters of California and Baja California for females (Reeves *et al.,* 2008; Maniscalco *et al.,* 2004). In the non-breeding season, an estimated 3,000 to 5,000 adult and sub-adult males migrate northward along the coast to central and northern California, Oregon, Washington, and Vancouver Island from September to May (Jeffries *et al.,* 2000) and return south the following spring (Mate, 1975; Bonnell *et al.,* 1983). During migration, they are occasionally sighted hundreds of miles offshore (Jefferson *et al.,* 1993). Females and juveniles tend to stay closer to the rookeries (Bonnell *et al.,* 1983). California sea lions do not breed in Washington, but are typically observed in Washington between August and April, after they have dispersed from breeding colonies.

California sea lions feed on a wide variety of prey, including many species of fish and squid (Everitt *et al.,* 1981; Roffe and Mate, 1984; Antonelis *et al.,* 1990; Lowry *et al.,* 1991). In some locations where salmon runs exist, California sea lions also feed on returning adult and out-migrating juvenile salmonids (London, 2006).

Sexual maturity occurs at around 4–5 years of age for California sea lions (Heath, 2002). California sea lions are gregarious during the breeding season and social on land during other times.

The California sea lion is the most frequently sighted pinniped found in Washington waters and uses haul-out sites along the outer coast, Strait of Juan de Fuca, and in Puget Sound. Haul-out sites are located on jetties, offshore rocks and islands, log booms, marine docks, and navigation buoys. This species is also frequently seen resting in the water together in groups in Puget Sound (Jeffries *et al.,* 2000). There are three documented California sea lion haul-outs near the proposed project area; all are located about six miles away and outside of the area of potential effects. These haul-outs include a yellow 'T' buoy off Alki Point, a yellow 'SG' buoy between West Point and Skiff Point, and a red buoy off Restoration Point (Jeffries *et al.,* 2000). The haul-outs have all been identified to have populations less than 100 individuals. It is assumed that California sea lions seen in and around the proposed project area use these haul-outs.

Acoustics—On land, California sea lions make incessant, raucous barking sounds; these have most of their energy at less than 2 kHz (Schusterman *et al.,* 1967). Males vary both the number and rhythm of their barks depending on the social context; the barks appear to control the movements and other behavior patterns of nearby conspecifics (Schusterman, 1977). Females produce barks, squeals, belches, and growls in the frequency range of 0.25–5 kHz, while pups make bleating sounds at 0.25–6 kHz. California sea lions produce two types of underwater sounds: clicks (or short-duration sound pulses) and barks (Schusterman *et al.,* 1966, 1967; Schusterman and Baillet, 1969). All of these underwater sounds have most of their energy below 4 kHz (Schusterman *et al.,* 1967).

The range of maximal hearing sensitivity for California sea lions underwater is between 1–28 kHz (Schusterman *et al.,* 1972). Functional underwater high frequency hearing limits are between 35–40 kHz, with peak sensitivities from 15–30 kHz (Schusterman *et al.,* 1972). The California sea lion shows relatively poor hearing at frequencies below 1 kHz (Kastak and Schusterman, 1998). Peak hearing sensitivities in air are shifted to lower frequencies; the effective upper hearing limit is approximately 36 kHz (Schusterman, 1974). The best range of sound detection is from 2–16 kHz (Schusterman, 1974). Kastak and Schusterman (2002) determined that hearing sensitivity generally worsens with depth—hearing thresholds were lower in shallow water, except at the highest frequency tested (35 kHz), where this trend was reversed. Octave band sound levels of 65–70 dB above the animal's threshold produced an average temporary threshold shift (TTS; discussed later in Potential Effects of the Specified Activity on Marine Mammals) of 4.9 dB in the California sea lion (Kastak *et al.,* 1999).

Steller Sea Lions

Species Description—Steller sea lions are the largest members of the Otariid (eared seal) family. Steller sea lions show marked sexual dimorphism, in which adult males are noticeably larger and have distinct coloration patterns from females. Males average about 1,500 lb (680 kg) and 10 ft (3 m) in length; females average about 700 lb (318 kg) and 8 ft (2.4 m) in length. Adult females have a tawny to silver-colored pelt. Males are characterized by dark, dense fur around their necks, giving a mane-like appearance, and light tawny coloring over the rest of their body (NMFS, 2008a). Steller sea lions are distributed mainly around the coasts to the outer continental shelf along the North Pacific Ocean rim from northern Hokkaido, Japan through the Kuril Islands and Okhotsk Sea, Aleutian Islands and central Bering Sea, southern coast of Alaska and south to California. The population is divided into the western and the eastern distinct population segments (DPSs) at 144° W (Cape Suckling, Alaska). The western DPS includes Steller sea lions that reside in the central and western Gulf of Alaska, Aleutian Islands, as well as those that inhabit coastal waters and breed in Asia (e.g., Japan and Russia). The eastern DPS extends from California to Alaska, including the Gulf of Alaska. Animals found in the proposed project area would be from the eastern DPS (NMFS, 1997a; Loughlin, 2002; Angliss and Outlaw, 2005).

Status—Steller sea lions were listed as threatened range-wide under the ESA in 1990. After division into two DPSs, the western DPS was listed as endangered under the ESA in 1997, while the eastern DPS remained classified as threatened. The eastern DPS breeds in rookeries located in southeast Alaska, British Columbia, Oregon, and California. While some pupping has been reported recently along the coast of Washington, there are no active rookeries in Washington. A final revised species recovery plan addresses both DPSs (NMFS, 2008a).

NMFS designated critical habitat for Steller sea lions in 1993. Critical habitat is associated with breeding and haul-out sites in Alaska, California, and Oregon, and includes so-called 'aquatic zones' that extend 3,000 ft (900 m) seaward in state and federally managed waters from the baseline or basepoint of each major rookery in Oregon and California (NMFS, 2008a). Three major rookery sites in Oregon (Rogue Reef, Pyramid Rock, and Long Brown Rock and Seal Rock on Orford Reef at Cape Blanco) and three rookery sites in California (Ano Nuevo, Southeast Farallon, and Sugarloaf Island and Cape Mendocino) are designated critical habitat (NMFS, 1993). There is no designated critical habitat within the proposed project area.

Factors that have previously been identified as threats to Steller sea lions include reduced food availability, possibly resulting from competition with commercial fisheries; incidental take and intentional kills during commercial fish harvests; subsistence take; entanglement in marine debris; disease; pollution; and harassment. Steller sea lions are also sensitive to disturbance at rookeries (during pupping and breeding) and haul-out sites.

The Recovery Plan for the Steller Sea Lion (NMFS, 2008a) states that the overall abundance of Steller sea lions in the eastern DPS has increased for a sustained period of at least three decades, and that pup production has increased significantly, especially since the mid-1990s. Between 1977 and 2002, researchers estimated that overall abundance of the eastern DPS had increased at an average rate of 3.1 percent per year (NMFS, 2008a; Pitcher *et al.,* 2007). NMFS' most recent stock assessment report estimates that population for the eastern DPS is a minimum of 52,847 individuals; this estimate is not corrected for animals at sea, and actual population is estimated to be within the range 58,334 to 72,223 (Allen and Angliss, 2010). The minimum count for Steller sea lions in Washington was 516 in 2001 (Pitcher *et al.,* 2007).

In the far southern end of Steller sea lion range (Channel Islands in southern California), population declined significantly after the 1930s—probably due to hunting and harassment (Bartholomew and Boolootian, 1960; Bartholomew, 1967)—and several rookeries and haul-outs have been abandoned. The lack of recolonization at the southernmost portion of the range (e.g., San Miguel Island rookery), despite stability in the non-pup portion of the overall California population, is likely a response to a suite of factors including changes in ocean conditions (e.g., warmer temperatures) that may be contributing to habitat changes that favor California sea lions over Steller sea lions (NMFS, 2007) and competition for space on land, and possibly prey, with species that have experienced explosive growth over the past three decades (e.g., California sea lions and northern elephant seals [*Mirounga angustirostris*]). Although recovery in California has lagged behind the rest of the DPS, this portion of the DPS' range has recently shown a positive growth rate (NMML, 2012). While non-pup counts in California in the 2000s are only 34 percent of pre-decline counts (1927–1947), the population has increased significantly since 1990. Despite the abandonment of certain rookeries in California, pup production at other rookeries in California has increased over the last 20 years and, overall, the eastern DPS has increased at an average annual growth rate of 4.3 percent per year for 30 years. Even though these rookeries might not be recolonized, their loss has not prevented the increasing abundance of Steller sea lions in California or in the eastern DPS overall.

Because the eastern DPS of Steller sea lion is currently listed as threatened under the ESA, it is therefore designated as depleted and classified as a strategic stock under the MMPA. However, the eastern DPS has been considered a potential candidate for removal from listing under the ESA by the Steller sea lion recovery team and NMFS (NMFS, 2008), based on observed annual rates of increase. Although the stock size has increased, the status of this stock relative to its Optimum Sustainable Population (OSP) size is unknown. The overall annual rate of increase of the eastern stock has been consistent and long-term, and may indicate that this stock is reaching OSP.

Behavior and Ecology—Steller sea lions forage near shore and in pelagic waters. They are capable of traveling long distances in a season and can dive to approximately 1,300 ft (400 m) in depth. They also use terrestrial habitat as haul-out sites for periods of rest, molting, and as rookeries for mating and pupping during the breeding season. At sea, they are often seen alone or in small groups, but may gather in large rafts at the surface near rookeries and haul-outs. Steller sea lions prefer the colder temperate to sub-arctic waters of the North Pacific Ocean. Haul-outs and rookeries usually consist of beaches (gravel, rocky or sand), ledges, and rocky reefs. In the Bering and Okhotsk Seas, sea lions may also haul-out on sea ice, but this is considered atypical behavior (NOAA, 2010a). Steller sea lions are opportunistic predators, feeding primarily on fish and cephalopods, and their diet varies geographically and seasonally (Bigg, 1985; Merrick *et al.,* 1997; Bredesen *et al.,* 2006; Guenette *et al.,* 2006). Foraging habitat is primarily shallow, nearshore and continental shelf waters; freshwater rivers; and also deep waters (Reeves *et al.,* 2008; Scordino, 2010).

Steller sea lions are gregarious animals that often travel or haul out in large groups of up to 45 individuals (Keple, 2002). At sea, groups usually consist of female and subadult males; adult males are usually solitary while at sea (Loughlin, 2002). In the Pacific Northwest, breeding rookeries are located in British Columbia, Oregon, and northern California. Steller sea lions form large rookeries during late spring when adult males arrive and establish territories (Pitcher and Calkins, 1981). Large males aggressively defend territories while non-breeding males remain at peripheral sites or haul-outs. Females arrive soon after and give birth. Most births occur from mid-May through mid-July, and breeding takes place shortly thereafter. Most pups are weaned within a year. Non-breeding individuals may not return to rookeries during the breeding season but remain at other coastal haul-outs (Scordino, 2006).

The nearest Steller sea lion haul-out to the proposed project area is about six miles away and outside the area of potential effects. This haul-out is composed of net pens offshore of the south end of Bainbridge Island. The population of Steller sea lions at this haul-out has been estimated at less than 100 individuals (Jeffries *et al.,* 2000). Review of many anecdotal accounts indicates that this species is rarely seen in the area of potential effects.

Acoustics—Like all pinnipeds, the Steller sea lion is amphibious; while all foraging activity takes place in the water, breeding behavior is carried out on land in coastal rookeries (Mulsow and Reichmuth 2008). On land, territorial male Steller sea lions regularly use loud, relatively low-frequency calls/roars to establish breeding territories (Schusterman *et al.,* 1970; Loughlin *et al.,* 1987). The calls of females range from 0.03 to 3 kHz, with peak frequencies from 0.15 to 1 kHz; typical duration is 1.0 to 1.5 sec (Campbell *et al.,* 2002). Pups also produce bleating sounds. Individually distinct vocalizations exchanged between mothers and pups are thought to be the main modality by which reunion occurs when mothers return to crowded rookeries following foraging at sea (Mulsow and Reichmuth, 2008).

Mulsow and Reichmuth (2008) measured the unmasked airborne hearing sensitivity of one male Steller sea lion. The range of best hearing sensitivity was between 5 and 14 kHz. Maximum sensitivity was found at 10 kHz, where the subject had a mean threshold of 7 dB. The underwater hearing threshold of a male Steller sea lion was significantly different from that of a female. The peak sensitivity range for the male was from 1 to 16 kHz, with maximum sensitivity (77 dB re: 1μPa-m) at 1 kHz. The range of best hearing for the female was from 16 to above 25 kHz, with maximum sensitivity (73 dB re: 1μPa-m) at 25 kHz. However, because of the small number of animals tested, the findings could not be attributed to either individual differences in sensitivity or sexual dimorphism (Kastelein *et al.,* 2005).

Harbor Porpoise

Species Description—Harbor porpoises inhabit northern temperate and subarctic coastal and offshore waters. They are commonly found in bays, estuaries, harbors, and fjords less than 650 ft (200 m) deep. In the North Atlantic, they range from West Greenland to Cape Hatteras, North Carolina and from the Barents Sea to West Africa. In the North Pacific, they are found from Japan north to the Chukchi Sea and from Monterey Bay, California to the Beaufort Sea. There are ten stocks of harbor porpoises in U.S. waters: Bering Sea, Gulf of Alaska, Gulf of Maine-Bay of Fundy, Inland Washington, Monterey Bay, Morro Bay, Northern California-Southern Oregon, Oregon-Washington Coastal, San Francisco-Russian River, and Southeast Alaska. Harbor porpoises that could potentially be in the proposed project area would be part of the Inland Washington stock.

Harbor porpoises have a small, robust body with a short, blunt beak. They typically weigh 135–170 pounds and are about 5 to 5.5 ft (1.5 to 1.7 m) in length. Females are slightly larger than males. All animals are dark gray with a white underside.

Status—Aerial surveys of the Strait of Juan de Fuca, San Juan Islands, Gulf Islands, and Strait of Georgia (which includes waters inhabited by the Washington Inland stock of harbor porpoise) were conducted during August of 2002 and 2003. The average abundance estimate resulting from those surveys is 3,123. When corrected for availability and perception bias, the estimated abundance for the Washington Inland stock in 2002/2003 is 10,682 animals. However, because the most recent abundance estimate is more than 8 years old, there is no current estimate of abundance available for this stock. Because there is no current estimate of minimum abundance, a PBR cannot be calculated for this stock. There is also no reliable data on long-term population trends of harbor porpoise for most waters of Oregon, Washington, or British Columbia. Harbor porpoises are not considered to be depleted under the MMPA or listed as threatened or endangered under the ESA.

Behavior and Ecology—Harbor porpoises are known to occur year-round in the inland trans-boundary waters of Washington and British Columbia and along the Oregon/Washington coast. Although differences in density exist between coastal Oregon/Washington and inland Washington waters, a specific stock boundary line cannot be identified based on biological or genetic differences. However, harbor porpoise movements and rates of intermixing within the eastern North Pacific are restricted, and there has been a significant decline in harbor porpoise sightings within southern Puget Sound since the 1940s, and today, harbor porpoise are rarely observed. Recently, there have been confirmed sightings of harbor porpoise in central Puget Sound (NMFS, 2006); however, no reports of harbor porpoises in the area of potential effects were made during 2011 (Whale Museum, 2011).

Harbor porpoises are non-social animals usually seen in groups of two to five animals. They feed on demersal and benthic species, mainly schooling fish and cephalopods.

Acoustics—Harbor porpoises are considered high-frequency cetaceans and their estimated auditory bandwidth ranges from 200 Hz to 180 kHz. Some studies suggest that harbor porpoises may be more sensitive to sound than other odontocetes (Lucke *et al.,* 2009; Kastelein *et al.,* 2011). In general, toothed whales produce a wide variety of sounds, which include species-specific broadband ''clicks'' with peak energy between 10 and 200 kHz, individually variable ''burst pulse'' click trains, and constant frequency or frequency-modulated (FM) whistles ranging from 4 to 16 kHz (Wartzok and Ketten, 1999). The general consensus is that the tonal vocalizations (whistles) produced by toothed whales play an important role in maintaining contact between dispersed individuals, while broadband clicks are used during echolocation (Wartzok and Ketten, 1999). Burst pulses have also been strongly implicated in communication, with some scientists suggesting that they play an important role in agonistic encounters (McCowan and Reiss, 1995), while others have proposed that they represent ''emotive'' signals in a broader sense, possibly representing graded communication signals (Herzing, 1996). Sperm whales, however, are known to produce only clicks, which are used for both communication and echolocation (Whitehead, 2003). Most of the energy of toothed whale social vocalizations is concentrated near 10 kHz, with source levels for whistles as high as 100 to 180 dB re 1 μPa at 1 m (Richardson *et al.,* 1995). No odontocete has been shown audiometrically to have acute hearing (<80 dB re 1 μPa) below 500 Hz (DoN, 2001). Sperm whales produce clicks, which may be used to echolocate (Mullins *et al.,* 1988), with a frequency range from less than 100 Hz to 30 kHz and source levels up to 230 dB re 1 μPa 1 m or greater (Mohl *et al.,* 2000).

Dall's Porpoise

Species Description—Dall's porpoises are common in the North Pacific Ocean, preferring temperate or cooler waters that are more than 600 ft (180 m) deep and with temperatures between 36–63 degrees Fahrenheit. For management purposes, Dall's porpoises inhabiting U.S. waters have been divided into two stocks: the Alaska stock and the California/Oregon/Washington stock. Dall's porpoises that could potentially be in the project area would be from the California/Oregon/Washington stock.

Dall's porpoises are fast swimming members of the porpoise family. They can weigh up to 480 pounds and grow up to 8 ft (2.4 m) long. They are identified by a dark gray or black body with variable contrasting white panels. These markings and colorations vary with geographic location and life stage.

Status—Dall's porpoise distribution in this region is highly variable between years and appears to be affected by oceanographic conditions. The most recent abundance estimate (42,000 animals) relies on estimates from 2005 and 2008 vessel-based line transect surveys off the coasts of California, Oregon, and Washington. Insufficient data are available to estimate current population trends. However, Dall's porpoises are generally considered reasonably abundant. There are an estimated 130,000 individuals in U.S. waters, including 76,000–99,500 off the Pacific coast (California, Oregon, and Washington) (NMFS, 2012). The PBR level for this stock is 257 animals per year. Dall's porpoises are not considered depleted under the MMPA or listed as threatened or endangered under the ESA.

Behavior and Ecology—Dall's porpoises can be found in offshore, inshore, and nearshore oceanic waters and are endemic to temperate waters of the North Pacific Ocean. Off the west coast, they are commonly seen in shelf, slope, and offshore waters. Sighting patterns from aerial and shipboard surveys conducted in California, Oregon, and Washington at different times suggest that north-south movement between these states occurs as oceanographic conditions change, both on seasonal and inter-annual scales. Only rarely have reports of Dall's porpoises been made for the area of potential effects. They feed on small schooling fish, mid- and deep-water fish, cephalopods, and occasionally crabs and shrimp. Feeding usually occurs at night when their prey vertically migrates up toward the water's surface. Dall's porpoises are capable of diving up to 1,640 ft (500 m) in order to reach their prey.

Acoustics—Dall's porpoises are considered high-frequency cetaceans their estimated auditory bandwidth ranges from 200 Hz to 180 kHz. General acoustic information on toothed whales was provided in the Harbor Porpoise section and is not repeated here.

Killer Whale

Species Description—Killer whales are the most widely distributed cetacean species in the world. Killer whales prefer colder waters, with the greatest abundances found within 800 km of major continents. Along the west coast of North America, killer whales occur along the entire Alaskan coast, in British Columbia and Washington inland waterways, and along the outer coasts of Washington, Oregon, and California. Based on morphology, ecology, genetics, and behavior, pods have been labeled as 'resident,' 'transient,' and 'offshore.' The distinct population segment of Southern resident killer whales is expected to have the highest potential of occurrence in the proposed project area. Transient killer whales may occasionally occur and are discussed where appropriate.

Killer whales are members of the dolphin family and can grow as long as 32 ft (9.8 m) and weigh as much as 22,000 pounds. They are identified by their large size and distinctive black and white appearance. Killer whales are highly social animals and often travel in groups of up to 50 animals. However, the Southern resident DPS is made up of three pods, and the one most likely to occur in the proposed project area—the J pod—has about 26 animals.

Status—The Eastern North Pacific Southern Resident stock is a trans-boundary stock including killer whales in inland Washington and southern British Columbia waters. Photoidentification of individual whales through the years has resulted in a substantial understanding of this stock's structure, behaviors, and movements. In 1993, the three pods comprising this stock totaled 96 killer whales (Ford *et al.,* 1994). The population increased to 99 whales in 1995, then declined to 79 whales in 2001, and most recently number 86 whales in 2010 (Ford *et al.,* 2000, Center for Whale Research, unpubl. data).

The Southern Resident killer whale is listed as endangered under the ESA and as strategic under the MMPA. Critical habitat was designated in 2006 and includes all marine waters greater than 20 ft in depth. Critical habitat for this DPS includes the summer core area in Haro Strait and waters around the San Juan Islands; Puget Sound; and the Strait of Juan de Fuca (NOAA, 2006). On November 27, 2012, NMFS announced a 90-day finding on a petition to delist the Southern Resident killer whale DPS (77 FR 70733, November 27, 2012). NMFS found that the petition action may be warranted and initiated a status review of Southern Resident killer whales to determine further action. The request for information period closed on January 28, 2013 and NMFS has not yet made a determination. Transient killer whales are not listed under the ESA, but are considered depleted under the MMPA.

Behavior and Ecology—Killer whales feed on a variety of fish, marine mammals, and sharks, depending on their population and geographic location. Resident populations in the eastern North Pacific feed mainly on salmonids, such as Chinook and chum salmon.

A long-term database maintained by the Whale Museum monitors sightings and geospatial locations of Southern Resident killer whale, among other marine mammals, in inland waters of Washington State. Data are largely based on opportunistic sightings from a variety of sources (i.e., public reports, commercial whale watching, Soundwatch, Lime Kiln State Park land-based observations, and independent research reports), but are regarded as a robust but difficult to quantify inventory of occurrences. The data provide the most comprehensive assemblage of broad-scale habitat use by the DPS in inland waters.

Based on reports from 1990 to 2008, the greatest number of unique killer whale sighting-days near or in the area of potential effects occurred from November through January, although observations were made during all months except May (Osborne, 2008). Most observations were of Southern Resident killer whales passing west of Alki Point (82 percent of all observations), which lies on the edge or outside the area of potential effects; a pattern potentially due to the high level of human disturbance or highly degraded habitat features currently found within Elliott Bay. Of the pods that compose this DPS, the J pod, with an estimated 26 members, is the pod most likely to appear year-round near the San Juan Islands, in the lower Puget Sound near Seattle, and in Georgia Strait at the mouth of the Fraser River. The J pod tends to frequent the west side of San Juan Island in mid to late spring (CWR, 2011). An analysis of 2011 sightings described an estimated 93 sightings of Southern Resident killer whales near the area of potential effects (Whale Museum, 2011). During this same analysis period, 12 transient killer whales were also observed near the area of potential effects. The majority of all sightings in this area are of groups of killer whales moving through the main channel between Bainbridge Island and Elliott Bay and outside the area of potential effects (Whale Museum, 2011). The purely descriptive format of these observations make it impossible to discern what proportion of the killer whales observed entered into the area of potential effects; however, it is assumed individuals may enter into this area on occasion.

Acoustics—Killer whales are considered mid-frequency cetaceans and their estimated auditory bandwidth ranges from 150 Hz to 160 kHz. General acoustics information for toothed whales was provided in the Harbor Porpoise section and is not repeated here.

Humpback Whale

Species Description—Humpbacks are large, dark grey baleen whales with some areas of white. They can grow up to 60 ft (18 m) long and weigh up to 40 tons. They are well known for their long pectoral fins, which can reach up to 15 ft (4.6 m) in length. Humpback whales live in all major oceans from the equator to sub-polar latitudes.

In the North Pacific, there are at least three separate populations: the California/Oregon/Washington stock, the Central North Pacific stock, and the Western North Pacific stock. Any humpbacks that may occur in the proposed project area would be part of the California/Oregon/Washington stock.

Status—The best estimate of abundance for the California/Oregon/Washington stock is 2,043 animals and based on a mark-recapture study. Ship surveys provide some indication that humpback whales increased in abundance in California coastal waters between 1979–1980 and 1991 (Barlow, 1994) and between 1991 and 2005 (Barlow and Forney, 2007; Forney, 2007), but this increase was not steady, and estimates showed a slight dip in 2001. Mark-recapture population estimates have shown a long-term increase of about 7.5 percent per year (Calambokidis, 2009), although there have been short-term declines during this period, probably due to oceanographic variability. Population estimates for the entire North Pacific have also increased substantially and the growth rate implied by these estimates (6–7 percent) is consistent with the recently observed growth rate of the California/Oregon/Washington stock (NMFS, 2011).

As a result of commercial whaling, humpback whales are listed as endangered under the ESA throughout their range and also considered depleted under the MMPA.

Behavior and Ecology—Humpback whales complete the farthest migration of any mammal each year. During the summer months, the California/Oregon/Washington stock spends the majority of their time feeding along the coast of North America. Humpback whales filter feed on tiny crustaceans (mostly krill), plankton, and small fish. This stock then spends winter in coastal Central America and Mexico engaging in mating activities.

Humpback whales are found in coastal waters of Washington as they migrate from feeding grounds to winter breeding grounds. Humpback whales are considered rare visitors to Puget Sound and are not observed in the area every year. Past sightings around Puget Sound and Hood Canal have taken place well away from the proposed project area; however, it is possible that they may occur at least once during the proposed construction period.

Acoustics—Baleen whale vocalizations are composed primarily of frequencies below 1 kHz, and some contain fundamental frequencies as low as 16 Hz (Watkins *et al.,* 1987; Richardson *et al.,* 1995; Rivers, 1997; Moore *et al.,* 1998; Stafford *et al.,* 1999; Wartzok and Ketten, 1999) but can be as high as 24 kHz for humpback whales (Au *et al.,* 2006). Clark and Ellison (2004) suggested that baleen whales use low-frequency sounds not only for long-range communication, but also as a simple form of echo ranging, using echoes to navigate and orient relative to physical features of the ocean. Information on auditory function in baleen whales is extremely lacking. Sensitivity to low-frequency sound by baleen whales has been inferred from observed vocalization frequencies, observed reactions to playback of sounds, and anatomical analyses of the auditory system. Although there is apparently much variation, the source levels of most baleen whale vocalizations lie in the range of 150–190 dB re 1 µPa at 1 m. Low-frequency vocalizations made by baleen whales and their corresponding auditory anatomy suggest that they have good low-frequency hearing (Ketten, 2000), although specific data on sensitivity, frequency or intensity discrimination, or localization abilities are lacking.

Gray Whale

Species Description—Gray whales are large baleen whales found mainly in shallow coastal waters of the North Pacific Ocean. They are identified by their mottled gray bodies, small eyes, and dorsal hump (not a dorsal fin). The can weigh up to 80,000 pounds and grow up to 50 ft (15 m) in length.

There are two isolated geographic distributions of gray whales in the North Pacific Ocean: the Eastern North Pacific stock and the Western North Pacific stock. Any gray whales occurring around the proposed project area would be part of the Eastern North Pacific stock, which includes the west coast of North America.

Status—Systematic counts of Eastern North Pacific gray whales migrating south along the Central California coast have been conducted by shore-based observers at Granite Canyon most years since 1967. The most recent abundance estimates are based on counts made during the 1997–1998, 2000–2001, and 2001–2002 southbound migrations, and range from about 18,000 to 30,000 animals. The population size of the Eastern North Pacific stock has been increasing over the past several decades despite an unusual mortality event in 1999 and 2000. The estimated annual rate of increase is 3.2–3.3 percent. In contrast the Western North Pacific population remains highly depleted.

While the Western North Pacific population is listed as endangered under the ESA, the Eastern North Pacific population was delisted from the ESA in 1994 after reaching a 'recovered' status. The Eastern North Pacific stock is not considered depleted under the MMPA.

Behavior and Ecology—Gray whales feed in shallow waters, usually 150–400 ft deep and adults consume over 1 ton of food per day during peak feeding periods. The gray whale is unique among cetaceans as a bottom-feeder that rolls onto its side, sucking up sediment from the seabed. Benthic organisms that live in the sediment are trapped by the baleen plates as water and silt are filtered out. Gray whales typically travel alone or in small, unstable groups.

Eastern North Pacific gray whales occur frequently off the coast of Washington during their southerly migration in November and December, and northern migration from March through May (Rugh *et al.,* 2001; Rice *et al.,* 1984). Gray whales are observed in Washington inland waters regularly between the months of January and September, with peaks between March and May. Gray whale sightings are typically reported in February through May and include an observation of a gray whale off the ferry terminal at Pier 52 heading toward the East Waterway in March 2010 (CWR, 2011; Whale Museum, 2012). Three gray whales were observed near the project area during 2011, but the narrative format of the observations makes it difficult to discern whether these individuals entered into the area of potential effects. It is assumed that gray whales might rarely occur in the area of potential effects.

Acoustics—Gray whale vocalizations and auditory function, like all baleen whale acoustics, is similar to that of humpback whales, described above. That information is not repeated here.

Potential Effects of the Specified Activity on Marine Mammals

SDOT's in-water construction activities (i.e., pile driving and removal) would introduce elevated levels of sound into the marine environment and have the potential to adversely impact marine mammals. The potential effects of sound from the proposed activities associated with the Elliott Bay Seawall project may include one or more of the following: tolerance; masking of natural sounds; behavioral disturbance; non-auditory physical effects; and temporary or permanent hearing impairment (Richardson *et al.,* 1995). However, for reasons discussed later in this document, it is unlikely that there would be any cases of temporary or permanent hearing impairment resulting from these activities. As outlined in previous NMFS documents, the effects of sound on marine mammals are highly variable, and can be categorized as follows (based on Richardson *et al.,* 1995):

- The sound may be too weak to be heard at the location of the animal (i.e., lower than the prevailing ambient sound level, the hearing threshold of the animal at relevant frequencies, or both);
- The sound may be audible but not strong enough to elicit any overt behavioral response;
- The sound may elicit reactions of varying degrees and variable relevance to the well-being of the marine mammal; these can range from temporary alert responses to active avoidance reactions such as vacating an area until the stimulus ceases, but potentially for longer periods of time;
- Upon repeated exposure, a marine mammal may exhibit diminishing responsiveness (habituation), or disturbance effects may persist; the latter is most likely with sounds that are highly variable in characteristics and unpredictable in occurrence, and associated with situations that a marine mammal perceives as a threat;
- Any anthropogenic sound that is strong enough to be heard has the potential to result in masking, or reduce the ability of a marine mammal to hear biological sounds at similar frequencies, including calls from conspecifics and underwater environmental sounds such as surf sound;
- If mammals remain in an area because it is important for feeding, breeding, or some other biologically important purpose even though there is chronic exposure to sound, it is possible that there could be sound-induced physiological stress; this might in turn have negative effects on the well-being or reproduction of the animals involved; and
- Very strong sounds have the potential to cause a temporary or permanent reduction in hearing sensitivity, also referred to as threshold shift. In terrestrial mammals, and presumably marine mammals, received sound levels must far exceed the animal's hearing threshold for there to be any temporary threshold shift (TTS). For transient sounds, the sound level necessary to cause TTS is inversely related to the duration of the sound. Received sound levels must be even higher for there to be risk of permanent hearing impairment (PTS). In addition, intense acoustic or explosive events may cause trauma to tissues associated with organs vital for hearing, sound production, respiration and other functions. This trauma may include minor to severe hemorrhage.

Tolerance

Numerous studies have shown that underwater sounds from industrial activities are often readily detectable by marine mammals in the water at distances of many kilometers. However, other studies have shown that marine mammals at distances more than a few kilometers away often show no apparent response to industrial activities of various types (Miller *et al.,* 2005). This is often true even in cases when the sounds must be readily audible to the animals based on measured received levels and the hearing sensitivity of that mammal group. Although various baleen whales, toothed whales, and (less frequently) pinnipeds have been shown to react behaviorally to underwater sound from sources such as airgun pulses or vessels under some conditions, at other times, mammals of all three types have shown no overt reactions (e.g., Malme *et al.,* 1986; Richardson *et al.,* 1995; Madsen and Mohl, 2000; Croll *et al.,* 2001; Jacobs and Terhune, 2002; Madsen *et al.,* 2002; Miller *et al.,* 2005). In general, pinnipeds seem to be more tolerant of exposure to some types of underwater sound than are baleen whales. Richardson *et al.* (1995) found that vessel sound does not seem to strongly affect pinnipeds that are already in the water. Richardson *et al.* (1995) went on to explain that seals on haul-outs sometimes respond strongly to the presence of vessels and at other times appear to show considerable tolerance of vessels, and Brueggeman *et al.* (1992) observed ringed seals (*Pusa hispida*) hauled out on ice pans displaying short-term escape reactions when a ship approached within 0.16–0.31 mi (0.25–0.5 km).

Masking

Masking is the obscuring of sounds of interest to an animal by other sounds, typically at similar frequencies. Marine mammals are highly dependent on sound, and their ability to recognize sound signals amid other sound is important in communication and detection of both predators and prey. Background ambient sound may interfere with or mask the ability of an animal to detect a sound signal even when that signal is above its absolute hearing threshold. Even in the absence of anthropogenic sound, the marine environment is often loud. Natural ambient sound includes contributions from wind, waves, precipitation, other animals, and (at frequencies above 30 kHz) thermal sound resulting from molecular agitation (Richardson *et al.,* 1995).

Background sound may also include anthropogenic sound, and masking of natural sounds can result when human activities produce high levels of background sound. Conversely, if the background level of underwater sound is high (e.g., on a day with strong wind and high waves), an anthropogenic sound source would not be detectable as far away as would be possible under quieter conditions and would itself be masked. Ambient sound is highly variable on continental shelves (Thompson, 1965; Myrberg, 1978; Chapman *et al.,* 1998; Desharnais *et al.,* 1999). This results in a high degree of variability in the range at which marine mammals can detect anthropogenic sounds.

Although masking is a phenomenon which may occur naturally, the introduction of loud anthropogenic sounds into the marine environment at frequencies important to marine mammals increases the severity and frequency of occurrence of masking. For example, if a baleen whale is exposed to continuous low-frequency sound from an industrial source, this would reduce the size of the area around that whale within which it can hear the calls of another whale. The components of background noise that are similar in frequency to the signal in question primarily determine the degree of masking of that signal. In general, little is known about the degree to which marine mammals rely upon detection of sounds from conspecifics, predators, prey, or other natural sources. In the absence of specific information about the importance of detecting these natural sounds, it is not possible to predict the impact of masking on marine mammals (Richardson *et al.,* 1995). In general, masking effects are expected to be less severe when sounds are transient than when they are continuous. Masking is typically of greater concern for those marine mammals that utilize low frequency communications, such as baleen whales and, as such, is not likely to occur for pinnipeds or small odontocetes in the Region of Activity.

Disturbance

Behavioral disturbance is one of the primary potential impacts of anthropogenic sound on marine mammals. Disturbance can result in a variety of effects, such as subtle or dramatic changes in behavior or displacement, but the degree to which disturbance causes such effects may be highly dependent upon the context in which the stimulus occurs. For example, an animal that is feeding may be less prone to disturbance from a given stimulus than one that is not. For many species and situations, there is no detailed information about reactions to sound.

Behavioral reactions of marine mammals to sound are difficult to predict because they are dependent on numerous factors, including species, maturity, experience, activity, reproductive state, time of day, and weather. If a marine mammal does react to an underwater sound by changing its behavior or moving a small distance, the impacts of that change may not be important to the individual, the stock, or the species as a whole. However, if a sound source displaces marine mammals from an important feeding or breeding area for a prolonged period, impacts on the animals could be important. In general, pinnipeds seem more tolerant of, or at least habituate more quickly to, potentially disturbing underwater sound than do cetaceans, and generally seem to be less responsive to exposure to industrial sound than most cetaceans. Pinniped responses to underwater sound from some types of industrial activities such as seismic exploration appear to be temporary and localized (Harris *et al.,* 2001; Reiser *et al.,* 2009).

Because the few available studies show wide variation in response to underwater and airborne sound, it is difficult to quantify exactly how pile driving sound would affect marine mammals in the area. The literature shows that elevated underwater sound levels could prompt a range of effects, including no obvious visible response, or behavioral responses that may include annoyance and increased alertness, visual orientation towards the sound, investigation of the sound, change in movement pattern or direction, habituation, alteration of feeding and social interaction, or temporary or permanent avoidance of the area affected by sound. Minor behavioral responses do not necessarily cause long-term effects to the individuals involved. Severe responses include panic, immediate movement away from the sound, and stampeding, which could potentially lead to injury or mortality (Southall *et al.,* 2007).

Southall *et al.* (2007) reviewed literature describing responses of pinnipeds to non-pulsed sound in water and reported that the limited data suggest exposures between approximately 90 and 140 dB generally do not appear to induce strong behavioral responses in pinnipeds, while higher levels of pulsed sound, ranging between 150 and 180 dB, will prompt avoidance of an area. It is important to note that among these studies, there are some apparent differences in responses between field and laboratory conditions. In contrast to the mid-frequency odontocetes, captive pinnipeds responded more strongly at lower levels than did animals in the field. Again, contextual issues are the likely cause of this difference. For airborne sound, Southall *et al.* (2007) note there are extremely limited data suggesting very minor, if any, observable behavioral responses by pinnipeds exposed to airborne pulses of 60 to 80 dB; however, given the paucity of data on the subject, we cannot rule out the possibility that avoidance of sound in the Region of Activity could occur.

In their comprehensive review of available literature, Southall *et al.* (2007) noted that quantitative studies on behavioral reactions of pinnipeds to underwater sound are rare. A subset of only three studies observed the response of pinnipeds to multiple pulses of underwater sound (a category of sound types that includes impact pile driving), and were also deemed by the authors as having results that are both measurable and representative. However, a number of studies not used by Southall *et al.* (2007) provide additional information, both quantitative and anecdotal, regarding the reactions of pinnipeds to multiple pulses of underwater sound.

Harris *et al.* (2001) observed the response of ringed, bearded (*Erignathus barbatus*), and spotted seals (*Phoca largha*) to underwater operation of a single air gun and an eleven-gun array. Received exposure levels were 160 to 200 dB. Results fit into two categories. In some instances, seals exhibited no response to sound. However, the study noted significantly fewer seals during operation of the full array in some instances. Additionally, the study noted some avoidance of the area within 150 m of the source during full array operations.

Blackwell *et al.* (2004) is the only cited study directly related to pile driving. The study observed ringed seals during impact installation of steel pipe pile. Received underwater SPLs were measured at 151 dB at 63 m. The seals exhibited either no response or only brief orientation response (defined as ''investigation or visual orientation''). It should be noted that the observations were made after pile driving was already in progress. Therefore, it is possible that the low-level response was due to prior habituation.

Miller *et al.* (2005) observed responses of ringed and bearded seals to a seismic air gun array. Received underwater sound levels were estimated at 160 to 200 dB. There were fewer seals present close to the sound source during air gun operations in the first year, but in the second year the seals showed no avoidance. In some instances, seals were present in very close range of the sound. The authors concluded that there was ''no observable behavioral response'' to seismic air gun operations.

During a Caltrans installation demonstration project for retrofit work on the East Span of the San Francisco Oakland Bay Bridge, California, sea lions responded to pile driving by swimming rapidly out of the area, regardless of the size of the pile-driving hammer or the presence of sound attenuation devices (74 FR 63724).

Jacobs and Terhune (2002) observed harbor seal reactions to acoustic harassment devices (AHDs) with source level of 172 dB deployed around aquaculture sites. Seals were generally unresponsive to sounds from the AHDs. During two specific events, individuals came within 141 and 144 ft (43 and 44 m) of active AHDs and failed to demonstrate any measurable behavioral response; estimated received levels based on the measures given were approximately 120 to 130 dB.

Costa *et al.* (2003) measured received sound levels from an Acoustic Thermometry of Ocean Climate (ATOC) program sound source off northern California using acoustic data loggers placed on translocated elephant seals. Subjects were captured on land, transported to sea, instrumented with archival acoustic tags, and released such that their transit would lead them near an active ATOC source (at 0.6 mi depth [939 m]; 75-Hz signal with 37.5-Hz bandwidth; 195 dB maximum source level, ramped up from 165 dB over 20 min) on their return to a haul-out site. Received exposure levels of the ATOC source for experimental subjects averaged 128 dB (range 118 to 137) in the 60- to 90-Hz band. None of the instrumented animals terminated dives or radically altered behavior upon exposure, but some statistically significant changes in diving parameters were documented in nine individuals. Translocated northern elephant seals exposed to this particular non-pulse source began to demonstrate subtle behavioral changes at exposure to received levels of approximately 120 to 140 dB.

Several available studies provide information on the reactions of pinnipeds to non-pulsed underwater sound. Kastelein *et al.* (2006) exposed nine captive harbor seals in an approximately 82 × 98 ft (25 × 30 m) enclosure to non-pulse sounds used in underwater data communication systems (similar to acoustic modems). Test signals were frequency modulated tones, sweeps, and bands of sound with fundamental frequencies between 8 and 16 kHz; 128 to 130 ±3 dB source levels; 1- to 2-s duration (60–80 percent duty cycle); or 100 percent duty cycle. They recorded seal positions and the mean number of individual surfacing behaviors during control periods (no exposure), before exposure, and in 15-min experimental sessions (n = 7 exposures for each sound type). Seals generally swam away from each source at received levels of approximately 107 dB, avoiding it by approximately 16 ft (5 m), although they did not haul out of the water or change surfacing behavior. Seal reactions did not appear to wane over repeated exposure (i.e., there was no obvious habituation), and the colony of seals generally returned to baseline conditions following exposure. The seals were not reinforced with food for remaining in the sound field.

Reactions of harbor seals to the simulated sound of a 2-megawatt wind power generator were measured by Koschinski *et al.* (2003). Harbor seals surfaced significantly further away from the sound source when it was active and did not approach the sound source as closely. The device used in that study produced sounds in the frequency range of 30 to 800 Hz, with peak source levels of 128 dB at 1 m at the 80- and 160-Hz frequencies.

Ship and boat sound do not seem to have strong effects on seals in the water, but the data are limited. When in the water, seals appear to be much less apprehensive about approaching vessels. Some would approach a vessel out of apparent curiosity, including noisy vessels such as those operating seismic airgun arrays (Moulton and Lawson, 2002). Gray seals (*Halichoerus grypus*) have been known to approach and follow fishing vessels in an effort to steal catch or the bait from traps. In contrast, seals hauled out on land often are quite responsive to nearby vessels. Terhune (1985) reported that northwest Atlantic harbor seals were extremely vigilant when hauled out and were wary of approaching (but less so passing) boats. Suryan and Harvey (1999) reported that Pacific harbor seals commonly left the shore when powerboat operators approached to observe the seals. Those seals detected a powerboat at a mean distance of 866 ft (264 m), and seals left the haul-out site when boats approached to within 472 ft (144 m).

The studies that address responses of high-frequency cetaceans (such as the harbor porpoise) to non-pulse sounds include data gathered both in the field and the laboratory and related to several different sound sources (of varying similarity to chirps), including: Pingers, AHDs, and various laboratory non-pulse sounds. All of these data were collected from harbor porpoises. Southall *et al.* (2007) concluded that the existing data indicate that harbor porpoises are likely sensitive to a wide range of anthropogenic sounds at low received levels (around 90 to 120 dB), at least for initial exposures. All recorded exposures above 140 dB induced profound and sustained avoidance behavior in wild harbor porpoises

(Southall *et al.,* 2007). Rapid habituation was noted in some but not all studies. Data on behavioral responses of high-frequency cetaceans to multiple pulses is not available. Although individual elements of some non-pulse sources (such as pingers) could be considered pulses, it is believed that some mammalian auditory systems perceive them as non-pulse sounds (Southall *et al.,* 2007).

Southall *et al.* (2007) also compiled known studies of behavioral responses of marine mammals to airborne sound, noting that studies of pinniped response to airborne pulsed sounds are exceedingly rare. The authors deemed only one study as having quantifiable results. Blackwell *et al.* (2004) studied the response of ringed seals within 500 m of impact driving of steel pipe pile. Received levels of airborne sound were measured at 93 dB at a distance of 63 m. Seals had either no response or limited response to pile driving. Reactions were described as ''indifferent'' or ''curious.''

Marine mammals are expected to traverse through and not remain in the project area. Therefore, animals are not expected to be exposed to a significant duration of construction sound.

Vessel Operations—A work/equipment barge and small range craft would be present in the Region of Activity at various times due to construction activities. The small range craft vessel would travel at low speeds and would be used to monitor for marine mammals in the area. Such vessels already use the Region of Activity in moderately high numbers; therefore, the vessels to be used in the Region of Activity do not represent a new sound source, only a potential increase in the frequency and duration of these sound source types.

There are very few controlled tests or repeatable observations related to the reactions of marine mammals to vessel noise. However, Richardson *et al.* (1995) reviewed the literature on reactions of marine mammals to vessels, concluding overall that pinnipeds and many odontocetes showed high tolerance to vessel noise. Mysticetes, too, often show tolerance of slow, quieter vessels. Because the Region of Activity is highly industrialized, it seems likely that marine mammals that transit the Region of Activity are already habituated to vessel noise, thus the additional vessels that would occur as a result of construction activities would likely not have an additional effect on these animals. Vessels occurring as a result of construction activities would be mostly stationary or moving slowly for marine mammal monitoring. Therefore, proposed vessel noise and operations in the Region of Activity is unlikely to rise to the level of harassment.

Physical Disturbance—Vessels and in-water structures have the potential to cause physical disturbance to marine mammals. As previously mentioned, various types of vessels already use the Region of Activity in high numbers. Tug boats and barges are slow moving and follow a predictable course. Marine mammals would be able to easily avoid these vessels while transiting through the Region of Activity and are likely already habituated to the presence of numerous vessels. Therefore, vessel strikes are extremely unlikely and, thus, discountable. Potential encounters would likely be limited to brief, sporadic behavioral disturbance, if any at all. Such disturbances are not likely to result in a risk of Level B harassment of marine mammals transiting the Region of Activity.

Hearing Impairment and Other Physiological Effects

Temporary or permanent hearing impairment is a possibility when marine mammals are exposed to very strong sounds. Non-auditory physiological effects might also occur in marine mammals exposed to strong underwater sound. Possible types of non-auditory physiological effects or injuries that may occur in mammals close to a strong sound source include stress, neurological effects, bubble formation, and other types of organ or tissue damage. It is possible that some marine mammal species (i.e., beaked whales) may be especially susceptible to injury and/or stranding when exposed to strong pulsed sounds, particularly at higher frequencies. Non-auditory physiological effects are not anticipated to occur as a result of proposed construction activities. The following subsections discuss the possibilities of TTS and PTS.

TTS—TTS, reversible hearing loss caused by fatigue of hair cells and supporting structures in the inner ear, is the mildest form of hearing impairment that can occur during exposure to a strong sound (Kryter, 1985). While experiencing TTS, the hearing threshold rises and a sound must be stronger in order to be heard. TTS can last from minutes or hours to (in cases of strong TTS) days. For sound exposures at or somewhat above the TTS threshold, hearing sensitivity in both terrestrial and marine mammals recovers rapidly after exposure to the sound ends.

Marine mammal hearing plays a critical role in communication with conspecifics and in 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 takes place during a time when the animal is traveling through the open ocean, 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 a time when communication is critical for successful mother/calf interactions could have more serious impacts if it were in the same frequency band as the necessary vocalizations and of a severity that it impeded communication. The fact that animals exposed to levels and durations of sound that would be expected to result in this physiological response would also be expected to have behavioral responses of a comparatively more severe or sustained nature is also notable and potentially of more importance than the simple existence of a TTS.

NMFS considers TTS to be a form of Level B harassment, as it consists of fatigue to auditory structures rather than damage to them. The NMFS-established 190-dB criterion is not considered to be the level above which TTS might occur. Rather, it is the received level above which, in the view of a panel of bioacoustics specialists convened by NMFS before TTS measurements for marine mammals became available, one could not be certain that there would be no injurious effects, auditory or otherwise, to marine mammals. Therefore, exposure to sound levels above 180 and 190 dB (for cetaceans and pinnipeds, respectively) does not necessarily mean that an animal has incurred TTS, but rather that it may have occurred. Few data on sound levels and durations necessary to elicit mild TTS have been obtained for marine mammals, and none of the published data concern TTS elicited by exposure to multiple pulses of sound.

Human non-impulsive sound exposure guidelines are based on exposures of equal energy (the same sound exposure level [SEL]; SEL is reported here in dB re: 1 μPa^2-s/re: 20 μPa^2-s for in-water and in-air sound, respectively) producing equal amounts of hearing impairment regardless of how the sound energy is distributed in time (NIOSH, 1998). Until recently, previous marine mammal TTS studies have also generally supported this equal energy relationship (Southall *et al.,* 2007). Three newer studies, two by Mooney *et al.* (2009a, b) on a single bottlenose dolphin (*Tursiops truncatus*) either exposed to playbacks of U.S. Navy mid-frequency active sonar or octave-band sound (4–8 kHz) and one by Kastak *et al.* (2007) on a single California sea lion exposed to airborne octave-band sound (centered at 2.5 kHz), concluded that for all sound exposure situations, the equal energy relationship may not be the best indicator to predict TTS onset levels. Generally, with sound exposures of equal energy, those that were quieter (lower SPL) with longer duration were found to induce TTS onset more than those of louder (higher SPL) and shorter duration. Given the available data, the received level of a single seismic pulse (with no frequency weighting) might need to be approximately 186 dB SEL in order to produce brief, mild TTS.

In free-ranging pinnipeds, TTS thresholds associated with exposure to brief pulses (single or multiple) of underwater sound have not been measured. However, systematic TTS studies on captive pinnipeds have been conducted (e.g., Bowles *et al.,* 1999; Kastak *et al.,* 1999, 2005, 2007; Schusterman *et al.,* 2000; Finneran *et al.,* 2003; Southall *et al.,* 2007). Specific studies are detailed here: Finneran *et al.* (2003) studied responses of two individual California sea lions. The sea lions were exposed to single pulses of underwater sound, and experienced no detectable TTS at received sound level of 183 dB peak (163 dB SEL). There were three studies conducted on pinniped TTS responses to non-pulsed underwater sound. All of these studies were performed in the same lab and on the same test subjects, and, therefore, the results may not be applicable to all pinnipeds or in field settings. Kastak and Schusterman (1996) studied the response of harbor seals to non-pulsed construction sound, reporting TTS of about 8 dB. The seal was exposed to broadband construction sound for 6 days, averaging 6 to 7 hours of intermittent exposure per day, with SPLs from just approximately 90 to 105 dB.

Kastak *et al.* (1999) reported TTS of approximately 4–5 dB in three species of pinnipeds (harbor seal, California sea lion, and northern elephant seal) after underwater exposure for approximately 20 minutes to sound with frequencies ranging from 100–2,000 Hz at received levels 60–75 dB above hearing threshold. This approach allowed similar effective exposure conditions to each of the subjects, but resulted in variable absolute exposure values depending on subject and test frequency. Recovery to near baseline levels was reported within 24 hours of sound exposure. Kastak *et al.* (2005) followed up on their previous work, exposing the same test subjects to higher levels of sound for longer durations. The animals were exposed to octave-band sound for up to 50 minutes of net exposure. The study reported that the harbor seal experienced TTS of 6 dB after a 25-minute exposure to 2.5 kHz of octave-band sound at 152 dB (183 dB SEL). The California sea lion demonstrated onset of TTS after exposure to 174 dB and 206 dB SEL.

Southall *et al.* (2007) reported one study on TTS in pinnipeds resulting from airborne pulsed sound, while two studies examined TTS in pinnipeds resulting from airborne non-pulsed sound. Bowles *et al.* (unpubl. data) exposed pinnipeds to simulated sonic booms. Harbor seals demonstrated TTS at 143 dB peak and 129 dB SEL. California sea lions and northern elephant seals experienced TTS at higher exposure levels than the harbor seals. Kastak *et al.* (2004) used the same test subjects as in Kastak *et al.* 2005, exposing the animals to non-pulsed sound (2.5 kHz octave-band sound) for 25 minutes. The harbor seal demonstrated 6 dB of TTS after exposure to 99 dB (131 dB SEL). The California sea lion demonstrated onset of TTS at 122 dB and 154 dB SEL. Kastak *et al.* (2007) studied the same California sea lion as in Kastak *et al.* 2004 above, exposing this individual to 192 exposures of 2.5 kHz octave-band sound at levels ranging from 94 to 133 dB for 1.5 to 50 min of net exposure duration. The test subject experienced up to 30 dB of TTS. TTS onset occurred at 159 dB SEL. Recovery times ranged from several minutes to 3 days.

Additional studies highlight the inherent complexity of predicting TTS onset in marine mammals, as well as the importance of considering exposure duration when assessing potential impacts (Mooney *et al.,* 2009a, 2009b; Kastak *et al.,* 2007). Generally, with sound exposures of equal energy, quieter sounds (lower SPL) of longer duration were found to induce TTS onset more than louder sounds (higher SPL) of shorter duration (more similar to subbottom profilers). For intermittent sounds, less threshold shift will occur than from a continuous exposure with the same energy (some recovery will occur between intermittent exposures) (Kryter *et al.,* 1966; Ward, 1997). For sound exposures at or somewhat above the TTS-onset threshold, hearing sensitivity recovers rapidly after exposure to the sound ends. Southall *et al.* (2007) considers a 6 dB TTS (that is, baseline thresholds are elevated by 6 dB) to be a sufficient definition of TTS-onset. NMFS considers TTS as Level B harassment that is mediated by physiological effects on the auditory system; however, NMFS does not consider TTS-onset to be the lowest level at which Level B harassment may occur. Southall *et al.* (2007) summarizes underwater pinniped data from Kastak *et al.* (2005), indicating that a tested harbor seal showed a TTS of around 6 dB when exposed to a nonpulse noise at sound pressure level 152 dB re: 1 µPa for 25 minutes.

Some studies suggest that harbor porpoises may be more sensitive to sound than other odontocetes (Lucke *et al.,* 2009; Kastelein *et al.,* 2011). While TTS onset may occur in harbor porpoises at lower received levels (when compared to other odontocetes), NMFS' 160-dB and 120-dB threshold criteria are based on the onset of behavioral harassment, not the onset of TTS. The potential for TTS is considered within NMFS' analysis of potential impacts from Level B harassment.

Impact pile driving for the Elliott Bay Seawall project would produce initial airborne sound levels of approximately 112 dB peak at 160 ft (49 m) from the source, as compared to the level suggested by Southall *et al.* (2007) of 143 dB peak for onset of TTS in pinnipeds from multiple pulses of airborne sound. It is not expected that airborne sound levels would induce TTS in individual pinnipeds.

Although underwater sound levels produced by the proposed project may exceed levels produced in studies that have induced TTS in marine mammals, there is a general lack of controlled, quantifiable field studies related to this phenomenon, and existing studies have had varied results (Southall *et al.,* 2007). Therefore, it is difficult to extrapolate from these data to site-specific conditions for the proposed project. For example, because most of the studies have been conducted in laboratories, rather than in field settings, the data are not conclusive as to whether elevated levels of sound would cause marine mammals to avoid the Region of Activity, thereby reducing the likelihood of TTS, or whether sound would attract marine mammals, increasing the likelihood of TTS. In any case, there are no universally accepted standards for the amount of exposure time likely to induce TTS. While it may be inferred that TTS could theoretically result from the proposed project, it is impossible to quantify the magnitude of exposure, the duration of the effect, or the number of individuals likely to be affected. Exposure is likely to be brief because marine mammals use the Region of Activity for transiting, rather than breeding or hauling out. In summary, it is expected that elevated sound would have only a slight probability of causing TTS in marine mammals.

PTS—When PTS occurs, there is physical damage to the sound receptors in the ear. In some cases, there can be total or partial deafness, whereas in other cases, the animal has an impaired ability to hear sounds in specific frequency ranges. There is no specific evidence that exposure to underwater industrial sounds can cause PTS in any marine mammal (see Southall *et al.,* 2007). However, given the possibility that marine mammals might incur TTS, there has been further speculation about the possibility that some individuals occurring very close to industrial activities might incur PTS. Richardson *et al.* (1995) hypothesized that PTS caused by prolonged exposure to continuous anthropogenic sound is unlikely to occur in marine mammals, at least for sounds with source levels up to approximately 200 dB. Single or occasional occurrences of mild TTS are not indicative of permanent auditory damage in terrestrial mammals. Studies of relationships between TTS and PTS thresholds in marine mammals are limited; however, existing data appear to show similarity to those found for humans and other terrestrial mammals, for which there is a large body of data. PTS might occur at a received sound level at least several decibels above that inducing mild TTS.

Southall *et al.* (2007) propose that sound levels inducing 40 dB of TTS may result in onset of PTS in marine mammals. The authors present this threshold with precaution, as there are no specific studies to support it. Because direct studies on marine mammals are lacking, the authors base these recommendations on studies performed on other mammals. Additionally, the authors assume that multiple pulses of underwater sound result in the onset of PTS in pinnipeds when levels reach 218 dB peak or 186 dB SEL. In air, sound levels are assumed to cause PTS in pinnipeds at 149 dB peak or 144 dB SEL (Southall *et al.,* 2007). Sound levels this high are not expected to occur as a result of the proposed activities.

The potential effects to marine mammals described in this section of the document do not take into consideration the proposed monitoring and mitigation measures described later in this document (see the Proposed Mitigation and Proposed Monitoring and Reporting sections). It is highly unlikely that marine mammals would receive sounds strong enough (and over a sufficient duration) to cause PTS (or even TTS) during the proposed activities. When taking the mitigation measures proposed for inclusion in the regulations into consideration, it is highly unlikely that any type of hearing impairment would occur as a result of SDOT's proposed activities.

Anticipated Effects on Marine Mammal Habitat

Construction activities would likely impact general marine mammal habitat and Southern resident killer whale critical habitat (designated throughout the Puget Sound region) in Elliott Bay and adjacent Puget Sound by producing temporary disturbances, primarily through elevated levels of underwater sound, reduced water quality, and physical habitat alteration associated with the structural footprint of the new seawall. Another potential temporary effect would be changes in prey species distribution during construction. However, overall, the proposed activity is expected to improve marine mammal habitat. Furthermore, sound levels constituting Level B harassment would not extend completely across Puget Sound, allowing marine mammals to avoid the higher levels of sound in Elliott Bay. Negative long-term effects are not anticipated.

A large portion of the Elliott Bay Seawall project is proposed habitat enhancement in the nearshore, which includes improving the quality of substrate, adding riparian plantings, burying contaminated sediment, and adding light-penetrating surfaces to overwater structures to enhance shallow water habitats for salmonid migration. In-water work during this part of the project may temporarily disturb marine mammals from general equipment/barge noise and temporarily increased turbidity. However, in the long-term, these habitat enhancements would likely benefit marine mammals indirectly as they are designed to increase habitat quality for prey species such as salmonids and marine invertebrates.

Marine mammals are especially vulnerable to contaminants because they are high up in the trophic level and may experience bioaccumulations. Water quality would generally improve as a result of the construction of stormwater treatment facilities associated with the Elliott Bay Seawall project. Currently, stormwater from the project area is discharged into Elliott Bay untreated. After completion of the proposed project, stormwater leaving the project area would receive treatment to remove suspended sediments and any pollutants bound to sediment. Analysis of post-project stormwater plumes conducted for the Endangered Species Act (ESA) analysis indicates that pollutants of concern to fish species will dilute to background concentrations generally within five feet of the outfalls; thus stormwater would have inconsequential effects on marine mammal prey species. The installation of the habitat features would generally bury up to two acres of low to moderately contaminated sediments and reduce the potential exposure of marine invertebrates and salmonids to contaminants and the potential for bioaccumulation up the food chain to marine mammals.

The underwater sounds would occur as short-term pulses (i.e., minutes to hours), separated by virtually instantaneous and complete recovery periods. These disturbances are likely to occur several times a day for up to a week, less than 1 week per year, for up to 7 years (5 years of activity would be authorized under this rule). Physical habitat alteration due to modification and replacement of existing in-water and over-water structures would also occur intermittently during construction, and would remain as the final, as-built project footprint for the design life of the Elliott Bay Seawall.

Elevated levels of sound may be considered to affect the in-water habitat of marine mammals via impacts to prey species or through passage obstruction (discussed later). However, due to the timing of the in-water work and the limited amount of pile driving that may occur on a daily basis, these effects on marine mammal habitat would be temporary and limited in duration. Any marine mammals that encounter increased sound levels would primarily be transiting the action area and foraging opportunistically. The direct loss of habitat available during construction due to sound impacts is expected to be minimal.

Impacts to Prey Species

Prey species for the various marine mammals that may occur in the proposed project area include marine invertebrates and fish. Short-term effects would occur to marine invertebrates immediately along the existing seawall during construction. The installation of the temporary containment wall would necessitate the removal of riprap that hosts various invertebrate and macroalgae species, and invertebrates present behind the temporary containment wall could experience mortality or decreased growth during the first season of construction occurring at each location. This effect is expected to be minor and short-term on the overall population of marine invertebrates in Elliott Bay. Construction would also have temporary effects on salmonids and other fish species in the project area due to disturbance, turbidity, noise, and the potential resuspension of contaminants.

Impact pile driving would produce a variety of underwater sound levels. Underwater sound caused by vibratory installation would be less than impact driving (Caltrans, 2009; WSDOT, 2010b). Literature relating to the impacts of sound on marine fish species can be divided into categories which describe the following: (1) Pathological effects; (2) physiological effects; and (3) behavioral effects. Pathological effects include lethal and sub-lethal physical damage to fish; physiological effects include primary and secondary stress responses; and behavioral effects include changes in exhibited behaviors of fish. Behavioral changes might be a direct reaction to a detected sound or a result of anthropogenic sound masking natural sounds that the fish normally detect and to which they respond. The three types of effects are often interrelated in complex ways. For example, some physiological and behavioral effects could potentially lead ultimately to the pathological effect of mortality. Hastings and Popper (2005) reviewed what is known about the effects of sound on fish and identified studies needed to address areas of uncertainty relative to measurement of sound and the responses of fish. Popper *et al.* (2003/2004) also published a paper that reviews the effects of anthropogenic sound on the behavior and physiology of fish. Please see those sources for more detail on the potential impacts of sound on fish.

Underwater sound pressure waves can injure or kill fish (e.g., Reyff, 2003; Abbott and Bing-Sawyer, 2002; Caltrans, 2001; Longmuir and Lively, 2001; Stotz and Colby, 2001). Fish with swim bladders, including salmon, steelhead, and sturgeon, are particularly sensitive to underwater impulsive sounds with a sharp sound pressure peak occurring in a short interval of time (Caltrans, 2001). As the pressure wave passes through a fish, the swim bladder is rapidly squeezed due to the high pressure, and then rapidly expanded as the underpressure component of the wave passes through the fish. The pneumatic pounding may rupture capillaries in the internal organs as indicated by observed blood in the abdominal cavity and maceration of the kidney tissues (Caltrans, 2001). Although eulachon lack a swim bladder, they are also susceptible to general pressure wave injuries including hemorrhage and rupture of internal organs, as described above, and damage to the auditory system. Direct take can cause instantaneous death, latent death within minutes after exposure, or can occur several days later. Indirect take can occur because of reduced fitness of a fish, making it susceptible to predation, disease, starvation, or inability to complete its life cycle.

All in-water work would occur during the designated in-water work window to avoid and minimize effects on juvenile salmonids. Additionally, marine resident fish species are only present in limited numbers along the seawall during the work season and primarily occur during the summer months when work would not be occurring. Prey species are expected to incur a long-term benefit from the proposed habitat enhancements; these enhancements would improve primary and secondary productivity and migratory habitat for salmonids.

Proposed Mitigation

In order to issue an incidental take authorization under section 101(a)(5)(A) of the MMPA, NMFS must, where applicable, set forth the permissible methods of taking pursuant to such activity, and other means of effecting the least practicable adverse impact on such species or stock and their 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 (where relevant). NMFS and SDOT worked to devise a number of mitigation measures designed to minimize impacts to marine mammals to the level of least practicable adverse impact.

Limited Impact Pile Driving

All sheet piles would be installed using a vibratory driver, unless impact driving is required to install piles that encounter consolidated sediments or for proofing load bearing sections. The use of vibratory pile driving reduces pile driving noise to levels less than the injury threshold for marine mammals. Any impact driving used in conjunction with vibratory pile driving would employ attenuation measures such as a cushioning block, where applicable. Any attenuation measures that become available for vibratory pile driving would also be considered for the proposed project.

Containment of Impact Pile Driving

The majority of permanent concrete piles would be driven behind the temporary containment wall that would function as a physical barrier to partially attenuate pile driving noise. Estimated noise-reduction values are not readily available for this attenuation type; however, it has been shown that the use of cofferdams, which are analogous to the temporary containment wall, is effective at reducing noise up to 10 dB (Caltrans, 2009).

Additional Attenuation Measures

Other attenuation measures such as bubble curtains may be employed as necessary to reduce sound levels. While bubble curtains were considered, they are not being proposed due to the potential for resuspension of contaminated materials and/or existing sediment caps; however, in some locations they could be feasible for the concrete pile driving and would be considered if sound levels are measured higher than what is shown in this analysis. In the event that underwater sound monitoring shows that noise generation from pile installation exceeds the levels originally expected, the implementation of additional attenuation devices would be reevaluated and discussed with NMFS.

Ramp-up

The objective of a ramp-up is to alert any animals close to the activity and allow them time to move away, which would expose fewer animals to loud sounds, including both underwater and above water sound. This procedure also ensures that any animals missed during monitoring within the exclusion zone would have the opportunity to move away from the activity and avoid injury. During all in-water pile-related activities, ramp-up would be used at the beginning of each day's in-water pile-related activities or if pile driving has ceased for more than 1 hour. If a vibratory driver is used, contractors would be required to initiate sound from vibratory hammers for 15 seconds at reduced energy followed by a 1-minute waiting period. The procedure would be repeated two additional times before full energy may be achieved. If a non-diesel impact hammer is used, contractors would be required to provide an initial set of strikes from the impact hammer at reduced energy, followed by a 1-minute waiting period, then two subsequent sets. The reduced energy of an individual hammer cannot be quantified because they vary by individual drivers. Also, the number of strikes would vary at reduced energy because raising the hammer at less than full power and then releasing it results in the hammer 'bouncing' as it strikes the pile, resulting in multiple strikes.

Marine Mammal Exclusion Zones

For this proposed project, the purpose of an exclusion zone is to prevent Level A harassment of all marine mammals and to reduce take of large whales from Level B harassment. SDOT would establish different exclusion zones for different types of in-water pile-related activities:

1. An exclusion zone for pinnipeds and small cetaceans with a radius of 200 ft waterward of each steel sheet pile source during impact pile driving;

2. An exclusion zone for pinnipeds and small cetaceans with a radius of 50 ft waterward of each concrete piling point source during impact pile driving;

3. An exclusion zone for large whales with a radius of 1,000 m (3,280 ft) waterward of each steel sheet or concrete pile during impact pile driving; and

4. An exclusion zone for large whales with a radius of 3,981 m (2.5 miles) waterward of each steel sheet pile source during vibratory pile driving.

The last two exclusion zones were recommended by NMFS to prevent the take of large whales by Level A harassment and reduce the take of large whales by Level B harassment. While the 3,981 m (2.5 mile) exclusion zone does not extend to the Level B harassment ispoleth for vibratory pile driving (6,276 m [3.9 miles]), it does cover a majority of the radius and allows for protected species observers to easily monitor the entrance of Elliott Bay from land. Temporary buoys would be used, as feasible, to mark the distance to the exclusion zones. These zones are intended to provide a physical threshold for a stop-work order for in-water pile-related activities if a marine mammal nears the proposed work area. At the start of in-water pile-related construction each day, a minimum of one qualified protected species observer would be staged on land (or an adjacent pier) near the location of in-water activities to document any marine mammal that approaches the exclusion zones. Additional land-based observers would be deployed if needed to ensure the construction area is adequately monitored. Land-based monitoring would occur throughout each day of active pile-related activities.

If a marine mammal is sighted approaching the work area, protected species observers would immediately notify the construction personnel operating the pile-related equipment of the direction of travel and distance relative to the exclusion zones. SDOT initially proposed that in-water pile-related stop-work order would be immediately triggered if a cetacean approaches or enters an exclusion zone or if an observer documents a pinniped displaying clear signs of stress or distress, such as difficulty swimming, breathing, or other disoriented behaviors. However, based on NMFS recommendation, a stop-work order would be triggered if any marine mammal enters an exclusion zone, regardless of observed behavior. SDOT's proposed exclusion zones would minimize injurious impacts to all marine mammals from increased sound exposures and would prevent take of large whales. The exclusion zones must not be obscured by fog or poor lighting conditions in order for in-water pile-related activities to begin/continue.

Shutdown and Delay Procedures

If a marine mammal is seen approaching or entering an exclusion zone, observers would immediately notify the construction personnel operating the pile-related equipment to shutdown pile-related activities. If a marine mammal(s) is present within the applicable exclusion zone prior to in-water pile-related activities, pile driving/removal would be delayed until the animal(s) has left the exclusion zone or until 15 minutes have elapsed without observing the animal.

Conclusions

NMFS has carefully evaluated the applicant's proposed mitigation measures and considered a range of other measures in the context of ensuring that NMFS prescribes the means of effecting the least practicable adverse impact on the affected marine mammal species and stocks and their habitat. Our evaluation of potential measures included consideration of the following factors in relation to one another:

- The manner in which, and the degree to which, the successful implementation of the measure is expected to minimize adverse impacts to marine mammals;
- The proven or likely efficacy of the specific measure to minimize adverse impacts as planned; and
- The practicability of the measure for applicant implementation.

Based on our evaluation, NMFS has preliminarily determined that the proposed mitigation measures provide the means of effecting the least practicable adverse impact on marine mammal species or stocks and their habitat, paying particular attention to rookeries, mating grounds, and areas of similar significance. The proposed rule comment period will afford the public an opportunity to submit recommendations, views, and/or concerns regarding this action and the proposed mitigation measures.

Proposed Monitoring and Reporting

In order to issue an incidental take authorization for an activity, section 101(a)(5)(A) of the MMPA states that NMFS must set forth, where applicable, ''requirements pertaining to the monitoring and reporting of such taking.'' The MMPA implementing regulations at 50 CFR 216.104 (a)(13) indicate that requests for incidental take authorizations must include the suggested means of accomplishing the necessary monitoring and reporting that 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.

Visual Monitoring

In addition to the mitigation monitoring described in the Marine Mammal Exclusion Zones section above, a minimum of two protected species observers would be positioned on land at the north and sound ends of Elliott Bay near the 2.5 mile exclusion zone to monitor for marine mammals during vibratory pile-related activities or any other construction activities that may pose a threat to marine mammals moving through the area. These observers would have no other responsibilities while on station. Observers would also be responsible for recording the location of all marine mammal sightings and logging information onto marine mammal sighting forms. Observers would use the naked eye, wide-angle binoculars with reticles, and spotting scopes to scan the area around their station. SDOT proposes to employ this monitoring every day during which vibratory pile driving occurs.

Each observer would work a maximum of 8 hours per day and would be relieved by a fresh observer if pile driving occurs over a longer day (i.e., 12 or 16 hours). The number of observers would be increased and/or positions changed to ensure full visibility of the area. All monitoring would begin at least 30 minutes prior to the start of in-water pile-related activities and continue during active construction. At a minimum, observers would record the following information:

- Date of observation period, monitoring type (land-based/boat-based), observer name and location, climate and weather conditions, and tidal conditions;

- Environmental conditions that could confound marine mammal detections and when/where they occurred;
- For each marine mammal sighting, the time of initial sighting and duration to the end of the sighting period;
- Observed species, number, group composition, distance to pile-related activities, and behavior of animals throughout the sighting;
- Discrete behavioral reactions, if apparent;
- Initial and final sighting locations marked on a grid map;
- Pile-related activities taking place during each sighting and if/why a shutdown was or was not triggered; and
- The number of takes (by species) of marine mammals, their locations, and behavior.

Acoustic Monitoring

SDOT would conduct acoustic monitoring during pile-related in-water work. The purpose of this monitoring would be to identify or confirm noise levels for pile-related work during in-water construction. Collection of acoustic data would be accomplished from both a drifting boat to reduce the effect of flow noise, and attached on or adjacent to piers located at 10 m from the pile source. All acoustical recordings would be conducted 1 m below the water surface and 1 m above the sea floor. Background noise recordings (in the absence of pile driving) would also be made to provide a baseline background noise profile. The results and conclusions of the study would be summarized and presented to NMFS with recommendations for any modifications to the monitoring plan or exclusion zones.

Underwater hydrophones and an airborne microphone would be used for acoustic recordings. All sensors, signal conditioning equipment, and sampling equipment would be calibrated at the start of the monitoring period and rechecked at the start of each day. A stationary two-channel hydrophone recording system would be deployed to record a representative sample (subset of piles) during the monitoring period. Prior to monitoring, water depth measurements would be taken to ensure that hydrophones do not drag on the bottom during tidal changes. One hydrophone would be placed at mid-depth and the other would be placed closer to the bottom (70 to 85 percent of the water depth). The depth with respect to the bottom may vary due to tidal changes and current effects since the hydrophones may be supported from a floating platform.

Appropriate measures would be taken to eliminate strumming of the hydroacoustic cable in the current and minimize flow noise over the hydrophones. There would be a direct line of acoustic transmission through the water column between the pile and the hydrophones in all cases, without any interposing structures, including other piles. At least one stationary land-based microphone would be deployed to record airborne sound levels produced during pile installation and removal. The microphone would measure far-field airborne sounds. A sound level meter with microphone would be located in the near-field if logistical and security constraints allow for the collection of near-field source level measurements. Near-field measurements would not be continuous and would be used to identify which sound sources are making significant contributions to the overall noise levels measured at the shoreline microphones. Specific locations would be determined by ease of access (terrain restrictions and presence of a road) and security permission. The microphone will be calibrated at the beginning of each day of monitoring activity.

To empirically verify the modeled behavioral disturbance zones, underwater and airborne acoustic monitoring would occur for the first five steel sheet pile and the first five concrete piles during the duration of pile driving. If a representative sample has not been achieved after the five piles have been monitored (e.g., if there is high variability of sound levels between pilings), acoustic monitoring would continue until a representative acoustic sample has been collected. Post-analysis of underwater sound level signals would include the following:

- RMS values (average, standard deviation/error, minimum, and maximum) for each recorded pile. The 10-second RMS averaged values will be used for determining the source value and extent of the 120 dB underwater isopleth;
- Frequency spectra for each functional hearing group; and
- Standardized underwater source levels to a reference distance of 10 m (33 ft).

Post-analysis of airborne noise would be presented in an unweighted format and include:

- The unweighted RMS values (average, minimum, and maximum) for each recorded pile. The average values would be used for determining the extent of the airborne isopleths relative to species-specific criteria;
- Frequency spectra from 10 Hz to 20 kHz for representative pile-related activity; and
- Standardized airborne source levels to a reference distance of approximately 15 m (50 ft).

It is intended that acoustic monitoring would be performed using a standardized method that would facilitate comparisons with other studies. Real-time monitoring of noise levels during in-water pile-related activities would ensure sound levels do not surpass those estimated in SDOT's application. In the event noise does surpass estimated levels for extended periods of time, construction would be stopped and NMFS would be contacted to discuss the cause and potential solutions.

Reporting

All marine mammal sightings would be documented by observers on a NMFS-approved sighting form. Takes of marine mammals would be recorded for any individual present within the area of potential effects. Marine mammal reporting would include all data described previously under Proposed Monitoring, including observation dates, times, and conditions, and any correlations of observed marine mammal behavior with activity type and received levels of sound, to the extent possible.

SDOT would also submit a report(s) concerning the results of all acoustic monitoring. This report(s) would include:

- Size and type of piles;
- A detailed description of any sound attenuation device used, including design specifications;
- The impact hammer energy rating used to drive the piles, make and model of the hammer(s), and description of the vibratory hammer;
- A description of the sound monitoring equipment;
- The distance between hydrophones and depth of water and the hydrophone locations;
- The depth of the hydrophones;
- The distance from the pile to the water's edge;
- The depth of water in which the pile was driven
- The depth into the substrate that the pile was driven
- The physical characteristics of the bottom substrate into which the pile were driven;
- The total number of strikes to drive each pile;
- The results of the hydroacoustic monitoring, including the frequency spectrum, ranges and means for the peak and RMS sound pressure levels,

and an estimation of the distance at which RMS values reach the relevant marine mammal thresholds and background sound levels. Vibratory driving results would include the maximum and overall average RMS calculated from 30-s RMS values during the drive of the pile;

• A description of any observable marine mammal behavior in the immediate area and, if possible, correlation to underwater sound levels occurring at that time.

Annual Reports—An annual report on marine mammal monitoring and mitigation would be submitted to NMFS, Office of Protected Resources, and NMFS, Northwest Regional Office. The annual reports would summarize information presented in the weekly reports and include data collected for each distinct marine mammal species observed in the project area, including descriptions of marine mammal behavior, overall numbers of individuals observed, frequency of observation, and any behavioral changes and the context of the changes relative to activities would also be included in the annual reports. Additional information that would be recorded during activities and contained in the reports include: date and time of marine mammal detections, weather conditions, species identification, approximate distance from the source, and activity at the construction site when a marine mammal is sighted.

Comprehensive Final Report—In addition to annual reports, NMFS proposes to require SDOT to submit a draft comprehensive final report to NMFS, Office of Protected Resources, and NMFS, Northwest Regional Office, 180 days prior to the expiration of the regulations. This comprehensive technical report would provide full documentation of methods, results, and interpretation of all monitoring during the first 4.5 years of the regulations. A revised final comprehensive technical report, including all monitoring results during the entire period of the regulations, would be due 90 days after the end of the period of effectiveness of the regulations.

Adaptive Management

The final regulations governing the take of marine mammals incidental to the specified activities at Elliott Bay would contain an adaptive management component. In accordance with 50 CFR 216.105(c), regulations for the proposed activity must be based on the best available information. As new information is developed, through monitoring, reporting, or research, the regulations may be modified, in whole or in part, after notice and opportunity for public review. The use of adaptive management would allow NMFS to consider new information from different sources to determine if mitigation or monitoring measures should be modified (including additions or deletions) if new data suggest that such modifications are appropriate. The following are some of the possible sources of applicable data:

• Results from SDOT's monitoring from the previous year;

• Results from general marine mammal and sound research; or

• Any information which reveals that marine mammals may have been taken in a manner, extent, or number not authorized by these regulations or subsequent LOAs.

If, during the effective dates of the regulations, new information is presented from monitoring, reporting, or research, these regulations may be modified, in whole or in part, after notice and opportunity of public review, as allowed for in 50 CFR 216.105(c). In addition, LOAs would be withdrawn or suspended if, after notice and opportunity for public comment, the Assistant Administrator finds, among other things, that the regulations are not being substantially complied with or that the taking allowed is having more than a negligible impact on the species or stock, as allowed for in 50 CFR 216.106(e). That is, should substantial changes in marine mammal populations in the project area occur or monitoring and reporting show that Elliott Bay Seawall actions are having more than a negligible impact on marine mammals, then NMFS reserves the right to modify the regulations and/or withdraw or suspend LOAs after public review.

Estimated Take by Incidental Harassment

Except with respect to certain activities not pertinent here, 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 by Level B harassment only is anticipated as a result of the installation and removal of piles via impact and vibratory methods. No take by injury, serious injury, or death is anticipated.

Typically, incidental take is estimated by multiplying the area of the zone of influence by the local animal density. This provides an estimate of the number of animals that might occupy the zone of influence at any time; however, there are no density estimates for marine mammal populations in Puget Sound. Therefore, the proposed take was estimated using anecdotal reports, incidental observations, and data from previous incidental take authorizations around Puget Sound. Anecdotal reports indicate that at most one to five individuals of each pinniped species may be present in the nearshore of the Seattle waterfront on a single day. Pinnipeds in the area are likely traveling to and from nearby haul-outs; harbor seals haul out around Alki Point, about 2.4 miles from the seawall and near Bainbridge Island, about six miles from the seawall; California sea lions haul out on buoys off Alki Point, between West Point and Skiff Point, and off Restoration Point, all about six miles from the seawall; and Steller sea lions haul out in Puget Sound near Bainbridge Island, seven miles from the seawall. Each pinniped haul out site is estimated to have less than 100 individuals, and the closest haul-out is 2.4 miles from the seawall. All other haul-outs are outside of the area of potential effects. SDOT provided an overestimate of up to 50 individuals in the area of potential effects each day of pile driving activities. SDOT then used the estimated number of vibratory pile installation/removal days to calculate the maximum number of takes that may occur each year. SDOT's estimated takes for harbor seals are presented in Table 10 of their LOA application.

However, NMFS determined that the take requests for pinnipeds are unreasonably overestimated. Considering (1) the lack of pinniped haul outs within the area of potential effects; (2) the likelihood that some animals may avoid the area during construction; (3) marine mammal surveys and take estimates from other projects in Puget Sound; and (4) anecdotal reports, NMFS estimates that a maximum of 20 harbor seals, 20 California sea lions, and 10 Steller sea lions may be present within the Level B harassment isopleth each day. Furthermore, NMFS used 35 days as the estimated number of vibratory and impact pile installation/removal days each year (as opposed to just vibratory) to calculate potential take. The total days of pile installation/removal were calculated based on the information in Tables 3 through 5 of this document. These estimates are still considered to overestimate the actual number of takes that would occur because takes are unlikely to occur during all impact pile driving activities (due to the smaller harassment isopleths) and the use of sound attenuation devices and other mitigation measures, which are not taken into consideration of the estimation of take. Furthermore, many takes would likely occur to the same individuals on different days and do not represent a total number of individuals.

SDOT does not have any documented occurrence of harbor porpoises or Dall's porpoise in the area of potential effects. However, these species are known to occur in adjacent areas of Puget Sound and may pass by Elliott Bay during the proposed activity. Average pod sizes are nine and 1–2 for harbor porpoise and Dall's porpoise, respectively. Therefore, SDOT and NMFS overestimate that a maximum of nine harbor porpoises and two Dall's porpoise could occur within the Level B harassment isopleth during each day of vibratory pile installation/removal. It is unlikely that any porpoises would be exposed to Level B take from impact pile driving due to the smaller harassment isopleths and absence from the nearshore area.

NMFS considers the take of large whales to be less likely due to the designated exclusion zone and shutdown procedures designed to reduce take by Level B harassment, as described in the Proposed Mitigation section of this document. However, because the Level B harassment zone extends into Puget Sound (where large whales are more likely to transit), NMFS is proposing to authorize take for a limited number of large whales. Based on the average group size of two animals and observed occurrence around the proposed project area, NMFS estimates that up to eight gray whales and four humpback whales per year (up to 40 gray whales and 20 humpback whales total over a 5-year period) may be exposed to sound that constitutes Level B harassment. For these reasons, NMFS is proposing to authorize take of eight marine mammals species: harbor seal, California sea lion, Steller sea lion, harbor porpoise, Dall's porpoise, killer whale, gray whale, and humpback whale. NMFS' estimated take of each species is summarized in Table 8.

TABLE 8—ESTIMATED MARINE MAMMAL TAKES FOR PROPOSED AUTHORIZATION

Species	Estimated maximum number of takes per day	Average number of pile driving days per year	Estimated number of takes per year	Percentage of stock that may be taken
Harbor seal	20	35 (vibratory + impact)	700	4.8
California sea lion	5	35 (vibratory + impact)	175	<0.1
Steller sea lion	5	35 (vibratory + impact)	175	0.3
Harbor porpoise	9	29 (vibratory)	315	2.9
Dall's porpoise	2	29 (vibratory)	70	0.2
Killer whale (Southern resident)			16	20
Killer whale (transient)			24	6.9
Gray whale			8	<0.1
Humpback whale			4	0.2

Negligible Impact and Small Numbers Analyses and Preliminary Determination

NMFS has defined 'negligible impact' in 50 CFR 216.103 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.'' In making a negligible impact determination, NMFS considers a variety of factors, including but not limited to: (1) The number of anticipated mortalities; (2) the number and nature of anticipated injuries; (3) the number, nature, intensity, and duration of Level B harassment; and (4) the context in which the takes occur.

Incidental take, in the form of Level B harassment only, is likely to occur as a result of marine mammal exposure to elevated levels of sound caused by impact and vibratory pile installation. No take by injury, serious injury, or death is anticipated or proposed to be authorized. By incorporating the proposed mitigation measures, including marine mammal monitoring and shut-down procedures described previously, harassment to individual marine mammals from the proposed activities is expected to be limited to temporary behavioral impacts. SDOT assumes that all individuals travelling past the project area would be exposed each time they pass the area and that all exposures would cause disturbance. NMFS agrees that this represents a worst-case scenario and is therefore sufficiently precautionary. There is only one pinniped haul-out located within the area of potential effects (2.4 miles from the seawall). The shutdown zone monitoring proposed as mitigation, and the small size of the zones in which injury may occur, makes any potential injury of marine mammals extremely unlikely, and therefore discountable. Because marine mammal exposures would be limited to the period they are transiting the disturbance zone, with potential repeat exposures separated by days to weeks, the probability of experiencing TTS is also considered unlikely.

These activities may cause individuals to temporarily disperse from the area or avoid transit through the area. However, existing traffic sound, commercial vessels, and recreational boaters already occur in the area. Thus, it is likely that marine mammals are habituated to these disturbances while transiting around and within Elliott Bay and would not be significantly hindered from transit. Behavioral changes are expected to potentially occur only when an animal is transiting a disturbance zone at the same time that the proposed activities are occurring. Although marine mammals are unlikely to be deterred from passing through the area, even temporarily, they may respond to the underwater sound by passing through the area more quickly, or they may experience stress as they pass through the area. Another possible effect is that the underwater sound would evoke a stress response in the exposed individuals, regardless of transit speed. However, the period of time during which an individual would be exposed to sound levels that might cause stress is short given their likely speed of travel through the affected areas. Considering the industrialized area where pile driving would occur, it is unlikely that the potential increased stress would have a significant effect on individuals or any effect on the population as a whole.

Therefore, NMFS finds it unlikely that the amount of anticipated disturbance would significantly change marine mammals' use of Elliott Bay. NMFS does not anticipate any effects on haul-out behavior because the closest haul-out is 2.4 miles from the seawall. All other effects of the proposed action are at most expected to have a discountable or insignificant effect on marine mammals, including an insignificant reduction in the quantity and quality of prey otherwise available.

Any adverse effects to prey species would occur on a temporary basis during project construction. Given the restricted in-water work window designed for the protection of salmonids and the short-term nature of effects to fish populations, as well as conservation and habitat mitigation measures that would continue into the future, the project is not expected to have significant effects on the distribution or abundance of potential prey species in the long-term. Therefore, these temporary impacts are expected to have an inconsequential on habitat for pinniped prey species.

A detailed description of potential impacts to individual pinnipeds was provided previously in this document. The following sections put into context what those effects mean to the respective populations or stocks of each of the marine mammal species potentially affected.

Harbor Seal

There is no current abundance estimate of the Washington inland stock of harbor seals, but the last estimate (more than 8 years ago) was 14,612. While new data are needed, the population is thought to be stable. The estimated take (by behavioral harassment only) of 700 individuals per year by Level B harassment is small relative to a stable population of approximately 14,612 (4.8 percent), and is not expected to impact annual rates of recruitment or survival of the stock. Harbor seals are not listed under the ESA nor considered depleted under the MMPA.

California Sea Lion

The U.S. stock of California sea lions is estimated at 296,750 and may be at carrying capacity. Generally, California sea lions in the Pacific Northwest are subadult or adult males (NOAA, 2008). The estimated take (by behavioral harassment only) of 175 individuals per year is small relative to a population of approximately 296,750 (<0.1 percent), and is not expected to impact annual rates of recruitment or survival of the stock. California sea lions are not listed under the ESA nor considered depleted under the MMPA.

Steller Sea Lion

The total population of the eastern DPS of Steller sea lions is estimated to be within a range from approximately 58,334 to 72,223 animals with an overall annual rate of increase of 3.1 percent throughout most of the range (Oregon to southeastern Alaska) since the 1970s (Allen and Angliss, 2010). In 2006, the NMFS Steller sea lion recovery team proposed removal of the eastern stock from listing under the ESA based on its annual rate of increase. The total estimated take (by behavioral harassment only) of 175 individuals per year is small compared to a population of approximately 65,000 (0.3 percent).

Harbor Porpoise

The total population of the Inland Washington stock was estimated to be 10,682 from 2002/2003 surveys. The estimated take (by behavioral harassment only) of an average of 315 individuals per year is small relative to a population of 10,682 (2.9 percent), and is not expected to impact annual rates of recruitment or survival of the stock. Harbor porpoises are not listed under the ESA nor considered depleted under the MMPA.

Dall's Porpoise

The total population of the California/Oregon/Washington stock is estimated at about 42,000 individuals, based on coastal surveys from 2005/2008. The PBR for this stock is 257 animals. The estimated take (by behavioral harassment only) of an average of 70 individuals per year is small relative to a population of 42,000 (0.2 percent), and is not expected to impact annual rates of recruitment or survival of the stock. Dall's porpoises are not listed under the ESA nor considered depleted under the MMPA.

Killer Whale

The total population of the Eastern North Pacific Southern Resident stock is estimated at 86 individuals. The PBR for this stock is 0.17 animals per year. The estimated take (by behavioral harassment only) of 16 animals per year is small relative to the a population of 86 (19 percent), and is not expected to impact annual rates of recruitment or survival of the stock. This is the maximum number of animals that would be exposed to elevated levels of sound per year and the proposed mitigation measures (e.g., marine mammal exclusion zone) would limit the number of exposures. The Eastern North Pacific Southern Resident stock of killer whales is listed as endangered under the ESA and considered depleted under the MMPA.

The total population of the Eastern North Pacific transient stock is estimated to be a minimum of 346 individuals. The PBR for this stock is 2.8 animals per year. The estimated take (by behavioral harassment only) of an average of 24 animals per year is small relative to a population of 346 (6.9 percent), and is not expected to impact annual rates of recruitment or survival of the stock. This stock of transient killer whales is not listed under the ESA nor considered depleted under the MMPA.

Gray Whale

The total population of the Eastern North Pacific stock is estimated at about 18,000 individuals. The PBR for this stock is 360 animals. The estimated take (by behavioral harassment only) of an average of eight animals per year is small relative to a population of 18,000 (<0.1 percent), and is not expected to impact annual rates of recruitment or survival of the stock. Gray whales are not listed under the ESA nor considered depleted under the MMPA.

Humpback Whale

The total population of the California/Oregon/Washington stock is estimated at about 2,043 individuals. The PBR for this stock is 11.3 animals per year. The estimated take (by behavioral harassment only) of an average of four animals per year is small relative to a population of 2,043 (0.2 percent), and is not expected to impact annual rates of recruitment or survival of the stock. Humpback whales are listed as endangered under the ESA and considered depleted under the MMPA.

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 mitigation and monitoring measures, NMFS preliminarily finds that SDOT's proposed activities would result in the incidental take of small numbers of marine mammals, by Level B harassment only, and that the total taking from SDOT's proposed activities would have a negligible impact on the affected species or stocks.

Impact on Availability of Affected Species or Stock for Taking for Subsistence Uses

Historically, Pacific Northwest treaty Indian tribes were known to utilize several species of marine mammals including, but not limited to: harbor seals, Steller sea lions, northern fur seals, gray whales, and humpback whales. More recently, several Pacific Northwest treaty Indian tribes have promulgated tribal regulations allowing tribal members to exercise treaty rights for subsistence harvest of harbor seals and California sea lions (Caretta *et al.* 2007). The Makah Indian Tribe (Makah) has specifically passed hunting regulations for gray whales, however, the directed take of marine mammals (not just gray whales) for ceremonial and/or subsistence purposes was enjoined by the Ninth Circuit Court of Appeals in a ruling against the Makah in 2002, 2003, and 2004 (NMFS, 2007). The issues surrounding the Makah gray whale hunt (in addition to the hunt for marine mammals in general) is currently in litigation or not yet clarified in recent court decisions. These issues also require National Environmental Policy Act (NEPA) and MMPA compliance, which has not yet been completed. Presently, there are no known active ceremonial and/or subsistence hunts for marine mammals in Puget Sound or the San Juan Islands with the following exceptions: (1) Tribes along the Pacific coast are most likely to still have regulations in place allowing a small number of directed take for subsistence purposes. It is unlikely that those regulations have been exercised in recent years, but they are likely still on the books. The Pacific Coast is separated by land and water bodies from the study area; and (2) Many tribes in Puget Sound and along the Pacific Coast have an additional current regulation that allows their fishermen to protect their life, gear, and catch from seals and California sea lions by lethal means. These rare takes are reported annually to NMFS by each tribe.

There have been only a few reported takes of harbor seals from directed tribal subsistence hunts (Caretta *et al.* 2007). It is possible that a few seals have been taken in directed hunts because tribal fishers use seals caught incidental to fishing operations in the northern Washington marine set gillnet and Washington Puget Sound Region treaty salmon gillnet fisheries for their subsistence needs before undertaking a ceremonial or subsistence hunt (Caretta *et al.* 2007). From communications with the tribes, the NMFS Northwest Regional Office believes that zero to five harbor seals from this stock (the Washington Inland Waters stock) may be taken annually in Puget Sound-directed subsistence harvests (Caretta *et al.* 2007). The location of the hunted animals or hunting areas is not currently known.

NMFS has determined that the total taking of affected species or stocks from the proposed Elliott Bay Seawall project would not have an unmitigable adverse impact on the availability of such species or stocks for taking for subsistence purposes.

Endangered Species Act (ESA)

Steller sea lions are listed as threatened under the ESA. However, the eastern DPS was proposed for removal from listing under the ESA on April 18, 2012 (77 FR 23209), based on observed annual rates of increase. The public comment period was open through June 18, 2012, and NMFS has not yet made a final decision. The Eastern North Pacific Southern resident stock of killer whales and humpback whales are listed as endangered under the ESA. SDOT has initiated section 7 consultation with NMFS Northwest Regional Office, and NMFS Office of Protected Resources, Permits and Conservation Division will also consult internally on the proposed project. This consultation will be concluded prior to the promulgation of final regulations (if issued).

National Environmental Policy Act (NEPA)

The Army Corps of Engineers is preparing an Environmental Assessment (EA) for the regulatory permit (section 404/10) required for Elliott Bay Seawall project. NMFS may adopt the Army Corps of Engineers' EA if it meets our needs. Otherwise NMFS will write our own EA to analyze the potential environmental effects of our proposed action of issuing an incidental take authorization. This will be concluded prior to our determination on the promulgation of final regulations.

Information Solicited

NMFS requests interested persons to submit comments, information, and suggestions concerning the request and the content of the proposed regulations to govern the taking described herein (see **ADDRESSES**).

Classification

The Office of Management and Budget (OMB) has determined that this proposed rule is not significant for purposes of Executive Order 12866.

Pursuant to section 605(b) of the Regulatory Flexibility Act (RFA), the Chief Counsel for Regulation of the Department of Commerce has certified to the Chief Counsel for Advocacy of the Small Business Administration (SBA) that this proposed rule, if adopted, would not have a significant economic impact on a substantial number of small entities. The SBA defines small entity as a small business, small organization, or a small governmental jurisdiction. Applying this definition, there are no small entities that are impacted by this proposed rule. This proposed rule impacts only the activities of SDOT and the City of Seattle, who have submitted a request for authorization to take marine mammals incidental to construction within Elliott Bay, over the course of 5 years. SDOT and the City of Seattle are not considered to be small governmental jurisdictions under the RFA's definition. Under the RFA, governmental jurisdictions are considered to be small if they are ''governments of cities, counties, towns, townships, villages, school districts, or special districts, with a population of less than 50,000, unless an agency establishes, after opportunity for public comment, one or more definitions of such term which are appropriate to the activities of the agency and which are based on such factors as location in rural or sparsely populated areas or limited revenues due to the population of such jurisdiction, and publishes such definition(s) in the **Federal Register**.'' Because this proposed rule impacts only the activities of SDOT, which is not considered to be a small entity within SBA's definition, the Chief Counsel for Regulation certified that this proposed rule will not have a significant economic impact on a substantial number of small entities. As a result of this certification, a regulatory flexibility analysis is not required and none has been prepared.

Notwithstanding any other provision of law, no person is required to respond to nor shall a person be subject to a penalty for failure to comply with a collection of information subject to the requirements of the Paperwork Reduction Act (PRA) unless that collection of information displays a currently valid OMB control number. This proposed rule contains collection-of-information requirements subject to the provisions of the PRA. These requirements have been approved by OMB under control number 0648–0151 and include applications for regulations, subsequent LOAs, and reports. Send comments regarding any aspect of this data collection, including suggestions for reducing the burden, to NMFS and the OMB Desk Officer (see **ADDRESSES**).

List of Subjects in 50 CFR Part 217

Imports, Marine mammals, Reporting and recordkeeping requirements.

Dated: April 4, 2013.

Alan D. Risenhoover,

Director, Office of Sustainable Fisheries, performing the functions and duties of the Deputy Assistant Administrator for Regulatory Programs, National Marine Fisheries Service.

For reasons set forth in the preamble, 50 CFR part 217 is proposed to be amended as follows:

PART 217—REGULATIONS GOVERNING THE TAKE OF MARINE MAMMALS INCIDENTAL TO SPECIFIED ACTIVITIES

■ 1. The authority citation for part 217 continues to read as follows:

Authority: 16 U.S.C. 1361 et seq.

■ 2. Subpart W is added to part 217 to read as follows:

Subpart W—Taking and Importing Marine Mammals; Elliott Bay Seawall Project

Subpart W—Taking of Marine Mammals Incidental to the Elliott Bay Seawall Project

§ 217.220 Specified activity and specified geographical region.

(a) Regulations in this subpart apply only to the Elliott Bay Seawall project and those persons it authorizes to conduct activities on its behalf for the taking of marine mammals that occurs in the area outlined in paragraph (b) of this section and that occurs incidental to seawall construction associated with the Elliott Bay Seawall project.

(b) The taking of marine mammals by the Seattle Department of Transportation (SDOT) and the City of Seattle (City) may be authorized in a Letter of Authorization (LOA) only if it occurs in Elliott Bay, Washington.

§ 217.221 [Reserved]

§ 217.222 Permissible methods of taking.

(a) Under LOAs issued pursuant to §§ 216.106 and 217.226 of this chapter, the Holder of the LOA (hereinafter ''SDOT'' and ''City'') may incidentally, but not intentionally, take marine mammals within the area described in § 217.220(b), provided the activity is in compliance with all terms, conditions, and requirements of the regulations in this subpart and the appropriate LOA.

(b) The incidental take of marine mammals under the activities identified in § 217.220(a) is limited to the indicated number of Level B harassment takes of the following species/stocks:

(1) Harbor seal (*Phoca vitulina*)—3,200 (an average of 640 animals per year)

(2) California sea lion (*Zalophus californianus*)—3,200 (an average of 640 animals per year)

(3) Steller sea lion (*Eumetopias jubatus*)—800 (an average of 160 animals per year)

(4) Harbor porpoise (*Phocoena phocoena*)—871 (an average of 175 animals per year)

(5) Dall's porpoise (*Phocoenoides dalli*)—195 (an average of 39 animals per year)

(6) Killer whale (*Orcinus orca*), Eastern North Pacific Southern resident—80 (a maximum of 16 animals per year)

(7) Killer whale (*Orcinus orca*), Eastern North Pacific transient—120 (an average of of 24 animals per year)

(8) Gray whale (*Eschrichtius robustus*)—40 (an average of 8 animals per year)

(9) Humpback whale (*Megaptera novaeangliae*)—20 (an average of 4 animals per year)

§ 217.223 Prohibitions.

Notwithstanding takings contemplated in § 217.222(b) and authorized by an LOA issued under § 216.106 and § 217.226 of this chapter, no person in connection with the activities described in § 217.220 may:

(a) Take any marine mammal not specified in § 217.222(b);

(b) Take any marine mammal specified in § 217.222(b) other than by incidental, unintentional Level B harassment;

(c) Take a marine mammal specified in § 217.222(b) if NMFS determines such taking results in more than a negligible impact on the species or stock of such marine mammal; or

(d) Violate, or fail to comply with, the terms, conditions, and requirements of this subpart or an LOA issued under § 216.106 and § 217.226 of this chapter.

§ 217.224 Mitigation.

(a) When conducting the activities identified in § 217.220(a), the mitigation measures contained in the LOA issued under § 216.106 and § 217.226 of this chapter must be implemented. These mitigation measures include:

(1) *Limited impact pile driving.* (i) All sheet piles shall be installed using a vibratory driver, unless impact driving is required to install piles that encounter consolidated sediments or for proofing load bearing sections.

(ii) Any impact driver used in conjunction with vibratory pile driving shall employ sound attenuation devices, where applicable.

(iii) Any attenuation devices that become available for vibratory pile driving shall be considered for additional mitigation.

(2) *Containment of impact pile driving.* (i) The majority of permanent concrete piles shall be driven behind the temporary containment wall.

(ii) [Reserved]

(3) *Additional attenuation measures.* (i) Other attenuation devices shall be used as necessary to reduce sound levels.

(ii) In the event that underwater sound monitoring shows that noise generation from pile installation exceeds the levels originally expected, SDOT and the City shall notify NMFS immediately to reevaluate the implementation of additional attenuation devices or other mitigation measures.

(4) *Ramp-up.* (i) Ramp-up shall be used at the beginning of each day's in-water pile-related activities or if pile driving has ceased for more than 1 hour.

(ii) If a vibratory hammer is used, contractors shall initiate sound from vibratory hammers for 15 seconds at reduced energy followed by a 1-minute waiting period. This procedure shall be repeated two additional times before full energy may be achieved.

(iii) If a non-diesel impact hammer is used, contractors shall provide an initial set of strikes from the impact hammer at reduced energy, followed by a 1-minute waiting period, then two subsequent sets.

(5) *Marine mammal exclusion zones.* (i) Exclusion zones shall be established to prevent the Level A harassment of all marine mammals and to reduce the Level B harassment of large whales.

(A) An exclusion zone for pinnipeds and small cetaceans shall be established with a radius of 200 feet (61 meters) waterward of each steel sheet pile during impact pile driving;

(B) An exclusion zone for pinnipeds and small cetaceans shall be established with a radius of 50 feet (15 meters) waterward of each concrete pile during impact pile driving;

(C) An exclusion zone for large whales shall be established with a radius of 3,280 feet (1,000 meters) waterward of each steel sheet or concrete pile during impact pile driving;

(D) An exclusion zone for large whales shall be established with a radius of 2.5 miles (3,981 meters) waterward of each steel sheet pile during vibratory pile driving.

(ii) Temporary buoys shall be used, as feasible, to mark the distance to each exclusion zone during in-water pile-related activities.

(iii) The exclusion zones shall be used to provide a physical threshold for the shutdown of in-water pile-related activities.

(iv) At the start of in-water pile related activities each day, a minimum of one qualified protected species observer shall be staged on land (or an adjacent pier) near the location of in-water pile-related activities to document and report any marine mammal that approaches or enters an exclusion zone throughout the day.

(v) Additional land-based observers shall be deployed if needed to ensure the construction area is adequately monitored.

(vi) Observers shall monitor for the presence of marine mammals 30 minutes before, during, and for 30 minutes after any in-water pile-related activities.

(vii) Exclusion zones shall not be obscured by fog or poor lighting conditions during in-water pile-related activities.

(6) *Shutdown and delay procedures.* (i) If a marine mammal is seen approaching or entering an exclusion zone (as specified in § 217.224(5)(i)), observers would immediately notify the construction personnel operating the pile-related equipment to shutdown pile-related activities.

(ii) If a marine mammal(s) is present within the applicable exclusion zone prior to in-water pile-related activities, pile driving/removal shall be delayed until the animal(s) has left the exclusion zone or until 15 minutes have elapsed without observing the animal.

(7) *Additional mitigation measures.* Additional mitigation measures as contained in an LOA issued under § 216.106 and § 217.226 of this chapter.

§ 217.225 Requirements for monitoring and reporting.

(a) When conducting the activities identified in § 217.220(a), the monitoring and reporting measures contained in the LOA issued under § 216.106 and § 217.226 of this chapter must be implemented. These measures include:

(1) *Visual monitoring.* (i) In addition to the mitigation monitoring described in § 217.224 of this chapter, at least two protected species observers shall be positioned on land near the 2.5 mile exclusion zone to monitor for marine mammals during vibratory pile-related activities or any other construction activities that may pose a threat to marine mammals.

(A) Observers shall use the naked eye, wide-angle binoculars with reticles, and any other necessary equipment to scan the Level B harassment isopleth.

(B) Observers shall work, on average, eight hours per day and shall be relieved by a fresh observer if pile driving lasts longer than usual (i.e., 12–16 hours).

(C) The number of observers shall be increased and/or positions changed to ensure full visibility of the Level B harassment isopleth.

(D) Land-based visual monitoring shall be conducted during all days of vibratory pile driving.

(E) All land-based monitoring shall begin at least 30 minutes prior to the start of in-water pile-related activities and continue during active construction.

(ii) At a minimum, observers shall record the following information:

(A) Date of observation period, monitoring type (land-based/boat-based), observer name and location, climate and weather conditions, and tidal conditions;

(B) Environmental conditions that could confound marine mammal detections and when/where they occurred;

(C) For each marine mammal sighting, the time of initial sighting and duration to the end of the sighting period;

(D) Observed species, number, group composition, distance to pile-related activities, and behavior of animals throughout the sighting;

(E) Discrete behavioral reactions, if apparent;

(F) Initial and final sighting locations marked on a grid map;

(G) Pile-related activities taking place during each sighting and if/why a shutdown was or was not triggered; and

(H) The number of takes (by species) of marine mammals, their locations, and behavior.

(2) *Acoustic monitoring.* (i) Acoustic monitoring shall be conducted during in-water pile-related activities to identify or confirm noise levels for pile-related activities during in-water construction.

(A) Acoustic data shall be collected using hydrophones connected to a drifting boat to reduce the effect of flow noise and an airborne microphone. There shall be a direct line of acoustic transmission through the water column between the pile and the hydrophones in all cases, without any interposing structures, including other piles.

(B) A stationary two-channel hydrophone recording system shall be deployed to record a representative sample (subset of piles) during the monitoring period. Acoustic data shall be collected 1 m below the water surface and 1 m above the sea floor.

(ii) Background noise recordings (in the absence of pile driving) shall be collected to provide a baseline background noise profile. The results and conclusions of the study shall be summarized and presented to NMFS with recommendations for any modifications to the monitoring plan or exclusion zones.

(iii) All sensors, signal conditioning equipment, and sampling equipment shall be calibrated at the start of the monitoring period and rechecked at the start of each day.

(iv) Prior to monitoring, water depth measurements shall be taken to ensure that hydrophones do not drag on the bottom during tidal changes.

(v) Underwater and airborne acoustic monitoring shall occur for the first five steel sheet pile and the first five concrete piles during the duration of pile driving. If a representative sample has not been achieved after the five piles have been monitored (e.g., if there is high variability of sound levels between pilings), acoustic monitoring shall continue until a representative acoustic sample has been collected.

(vi) Acoustic data shall be downloaded periodically (i.e., daily or on another appropriate schedule) and analyzed following the first year of construction. Post-analysis of underwater sound level signals shall include the following:

(A) RMS values (average, standard deviation/error, minimum, and maximum) for each recorded pile. The 10-second RMS averaged values will be used for determining the source value and extent of the 120 dB underwater isopleth;

(B) Frequency spectra for each functional hearing group; and

(C) Standardized underwater source levels to a reference distance of 10 m (33 ft).

(vii) Post-analysis of airborne noise would be presented in an unweighted format and include:

(A) The unweighted RMS values (average, minimum, and maximum) for each recorded pile. The average values would be used for determining the extent of the airborne isopleths relative to species-specific criteria;

(B) Frequency spectra from 10 Hz to 20 kHz for representative pile-related activity; and

(C) Standardized airborne source levels to a reference distance of approximately 15 m (50 ft).

(viii) In the event noise levels surpass estimated levels for extended periods of time, construction shall be stopped and NMFS shall be contacted to discuss the cause and potential solutions.

(3) *General reporting.* (i) All marine mammal sightings shall be documented by observers on a NMFS-approved sighting form. Takes of marine mammals shall be recorded for any individual present within the area of potential effects.

(ii) Marine mammal reporting shall include all data described previously under Proposed Monitoring, including observation dates, times, and conditions, and any correlations of observed marine mammal behavior with activity type and received levels of sound, to the extent possible.

(iii) A report with the results of all acoustic monitoring shall include the following:

(A) Size and type of piles;

(B) A detailed description of any sound attenuation device used, including design specifications;

(C) The impact hammer energy rating used to drive the piles, make and model of the hammer(s), and description of the vibratory hammer;

(D) A description of the sound monitoring equipment;

(E) The distance between hydrophones and depth of water and the hydrophone locations;

(F) The depth of the hydrophones;

(G) The distance from the pile to the water's edge;

(H) The depth of water in which the pile was driven;

(I) The depth into the substrate that the pile was driven;

(J) The physical characteristics of the bottom substrate into which the pile were driven;

(K) The total number of strikes to drive each pile;

(L) The results of the hydroacoustic monitoring, including the frequency spectrum, ranges and means for the peak and RMS sound pressure levels, and an estimation of the distance at which RMS values reach the relevant marine mammal thresholds and background sound levels.

(M) Vibratory driving results would include the maximum and overall average RMS calculated from 30-s RMS values during the drive of the pile; and

(N) A description of any observable marine mammal behavior in the immediate area and, if possible, correlation to underwater sound levels occurring at that time.

(iv) An annual report on monitoring and mitigation shall be submitted to NMFS, Office of Protected Resources, and NMFS, Northwest Regional Office.

(A) The annual reports shall summarize include data collected for each marine mammal species observed in the project area, including descriptions of marine mammal behavior, overall numbers of individuals observed, frequency of observation, any behavioral changes and the context of the changes relative to activities would also be included in the annual reports, date and time of marine mammal detections, weather conditions, species identification, approximate distance from the source, and activity at the construction site when a marine mammal is sighted.

(v) A draft comprehensive report on monitoring and mitigation shall be submitted to NMFS, Office of Protected Resources, and NMFS, Northwest Regional Office, 180 days prior to the expiration of the regulations.

(A) The comprehensive technical report shall provide full documentation of methods, results, and interpretation of all monitoring during the first 4.5 years of the regulations. A revised final comprehensive technical report, including all monitoring results during the entire period of the regulations, shall be due 90 days after the end of the period of effectiveness of the regulations.

(B) [Reserved]

(4) *Reporting injured or dead marine mammals.* (i) In the unanticipated event that the specified activity clearly causes the take of a marine mammal in a manner prohibited by an LOA (if issued), such as an injury (Level A harassment), serious injury, or mortality, the Holder shall immediately cease the specified activities and report the incident to the Chief of the Permits and Conservation Division, Office of Protected Resources, NMFS, and the Northwest Regional Stranding Coordinator. The report must include the following information:

(A) Time and date of the incident;

(B) Description of the incident;

(C) Environmental conditions (e.g., wind speed and direction, Beaufort sea state, cloud cover, and visibility);

(D) Description of all marine mammal observations in the 24 hours preceding the incident;

(E) Species identification or description of the animal(s) involved;

(F) Fate of the animal(s); and

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

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

(iii) In the event that the Holder discovers an injured or dead marine mammal, and the lead protected species 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 Holder shall immediately report the incident to the Chief of the Permits and Conservation Division, Office of Protected Resources, NMFS, and the Northwest Regional Stranding Coordinator. The report must include the same information identified in § 217.225(a)(3) of this chapter. Activities may continue while NMFS reviews the circumstances of the incident. NMFS will work with the Holder to determine whether additional mitigation measures or modifications to the activities are appropriate.

(iv) In the event that the Holder discovers an injured or dead marine mammals, and the lead protected species observer determines that the injury or death is not associated with or related to the activities authorized in the LOA (e.g., previously wounded animal, carcass with moderate to advanced decomposition, or scavenger damage), the Holder shall report the incident to the Chief of the Permits and Conservation Division, Office of Protected Resources, NMFS, and the Northwest Regional Stranding Coordinator, within 24 hours of the discovery. The Holder shall provide photographs or video footage or other documentation of the stranding animal sighting to NMFS.

(b) [Reserved]

§ 217.226 Letters of Authorization.

(a) To incidentally take marine mammals pursuant to these regulations, the applicant must apply for and obtain an LOA.

(b) An LOA, unless suspended or revoked, may be effective for a period of time not to exceed the expiration date of these regulations.

(c) If an LOA expires prior to the expiration date of these regulations, the Holder must apply for and obtain a renewal of the LOA.

(d) In the event of projected changes to the activity or to mitigation and monitoring measures required by an LOA, the Holder must apply for and obtain a modification of the LOA as described in § 217.227.

(e) The LOA shall set forth:

(1) Permissible methods of incidental taking;

(2) Means of effecting the least practicable adverse impact (i.e., mitigation) on the species, its habitat,

and on the availability of the species for subsistence uses; and

(3) Requirements for monitoring and reporting.

(f) Issuance of the LOA shall be based on a determination that the level of taking will be consistent with the findings made for the total taking allowable under these regulations.

(g) Notice of issuance or denial of an LOA shall be published in the **Federal Register** within 30 days of a determination.

§ 217.227 Renewals and modifications of Letters of Authorization.

(a) An LOA issued under §§ 216.106 and 217.226 of this chapter for the activity identified in § 217.220(a) of this chapter shall be renewed or modified upon request by the applicant, provided that:

(1) The proposed specified activity and mitigation, monitoring, and reporting measures, as well as the anticipated impacts, are the same as those described and analyzed for these regulations (excluding changes made pursuant to the adaptive management provision in § 217.227(c)(1)), and

(2) NMFS determines that the mitigation, monitoring, and reporting measures required by the previous LOA under these regulations were implemented.

(b) For LOA modification or renewal requests by the applicant that include changes to the activity or the mitigation, monitoring, or reporting (excluding changes made pursuant to the adaptive management provision in § 217.227(c)(1)) that do not change the findings made for the regulations or result in no more than a minor change in the total estimated number of takes (or distribution by species or years), NMFS may publish a notice of proposed LOA in the **Federal Register**, including the associated analysis illustrating the change, and solicit public comments before issuing the LOA.

(c) An LOA issued under §§ 216.106 and 217.226 of this chapter for the activity identified in § 217.220(a) may be modified by NMFS under the following circumstances:

(1) *Adaptive management.* NMFS may modify (including augment) the existing mitigation, monitoring, or reporting measures (after consulting with the Holder regarding the practicability of the modifications) if doing so creates a reasonable likelihood of more effectively accomplishing the goals of the mitigation and monitoring set forth in the preamble for these regulations.

(i) Possible sources of data that could contribute to the decision to modify the mitigation, monitoring, or reporting measures in an LOA include the following:

(A) Results from the Holder's monitoring from the previous year(s);

(B) Results from other marine mammal and/or sound research or studies;

(C) Any information that reveals marine mammals may have been taken in a manner, extent, or number not authorized by these regulations or subsequent LOAs.

(ii) If, through adaptive management, the modifications to the mitigation, monitoring, or reporting measures are substantial, NMFS will publish a notice of proposed LOA in the **Federal Register** and solicit public comments.

(2) *Emergencies.* If NMFS determines that an emergency exists that poses a significant risk to the well-being of the species or stocks of marine mammals specified in § 217.222(b), an LOA may be modified without prior notice or opportunity for public comment. A notice would be published in the **Federal Register** within 30 days of the action.

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