
**FINAL ACOUSTIC AND MARINE MAMMAL MONITORING PLAN FOR
THE NAVY'S FUEL PIER REPLACEMENT PROJECT AT
NAVAL BASE POINT LOMA**



Submitted to:

**Office of Protected Resources,
National Marine Fisheries Service,
National Oceanographic and Atmospheric Administration**

Prepared by:

Naval Facilities Engineering Command

For:

Naval Base Point Loma

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1.0 INTRODUCTION

1.1 Purpose of the Monitoring Plan

The purpose of this Monitoring Plan is to provide protocols for acoustic and marine mammal monitoring during the proposed pile removal and construction at the Navy Marine Mammal Program relocation site (Naval Mine and Antisubmarine Warfare Center [NMAWC]), during the Indicator Pile Program (IPP), in-water demolition and project pile driving activities that are part of the Navy's Fuel Pier Replacement Project at Naval Base Point Loma (NBPL), California (Figure 1-1). This plan was developed to support the National Marine Fisheries (NMFS) Incidental Harassment Authorization (IHA) (Navy 2013).

Acoustic monitoring will be conducted with the following objectives:

1. Indicator Pile Program (IPP) – Implement a robust in-situ monitoring effort to measure sound pressure levels from different project activities, including driving the 36 and 48 inch piles, to validate the acoustic zones of influence (ZOIs) contours developed through the Transmission Loss Modeling effort. It is assumed that the measured contours will be significantly reduced compared to the conservatively modeled ZOI's. If there is significant distance between the measured contour ZOI's and the modeled contour ZOI's, the marine mammal monitoring stations may be adjusted as appropriate.
2. Continue the Navy's collection of ambient underwater sound measurements in the absence of project activities to develop a rigorous baseline for the San Diego Bay region.
3. Determine spreading loss to airborne and underwater sound generated by construction and demolition activities.

Marine mammal monitoring will be conducted before, during, and after pile driving and extraction activities within the ZOIs of potential injury and behavioral disturbance thresholds. The proposed monitoring will determine the species and numbers of marine mammals exposed to underwater and airborne sound levels that would constitute takes under the Marine Mammal Protection Act (MMPA). As statistically robust results from acoustic monitoring become available, marine mammal monitoring protocols would be proposed to encompass actual ZOIs in the second IHA application.

1.2 Scope and Timing

The scope of the Monitoring Plan includes the IPP, pile driving and pile extraction activities that are necessary for the Fuel Pier Replacement Project, including temporary relocation of the Navy Marine Mammal Program to NMAWC. For the purpose of this submittal to NMFS, the scope of monitoring is limited to acoustics and marine mammals. Acoustic and marine mammal monitoring would be integrated with other marine environmental monitoring if such monitoring is required as a result of the Navy's National Environmental Policy Act (NEPA) project review or as a condition of approval by other regulatory agencies.

This Monitoring Plan will be implemented during the period of the first IHA (September 2013 through April 2014) for the project, and during each subsequent IHA issued for the project. Based on the experience of the first IHA period, modifications or additions may be made to the Monitoring Plan, in which case those changes would be submitted for review and approval to NMFS as part of the application for the subsequent IHA.

Apart from this Monitoring Plan, the Navy intends to continue its baseline marine mammal and hydroacoustic surveys of San Diego Bay as described in detail in the IHA application. The Navy will continue to share and discuss the results with NMFS.

1.3 Management

The Monitoring Plan will be managed by Naval Facilities Engineering Command (NAVFAC) Southwest. Acoustic and marine mammals monitoring will be carried out by private contractors supported by local technical staff from NAVFAC Southwest, University of Washington, and the Space and Naval Warfare (SPAWAR) Systems Center (SSC) Pacific. NAVFAC Southwest will also be responsible for preparation of the Monitoring Report for the first and subsequent IHAs.

Final Acoustic and Marine Mammal Monitoring Plan for the
Navy's Fuel Pier Replacement Project at Naval Base Point Loma

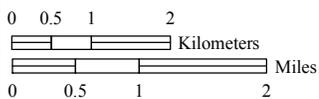
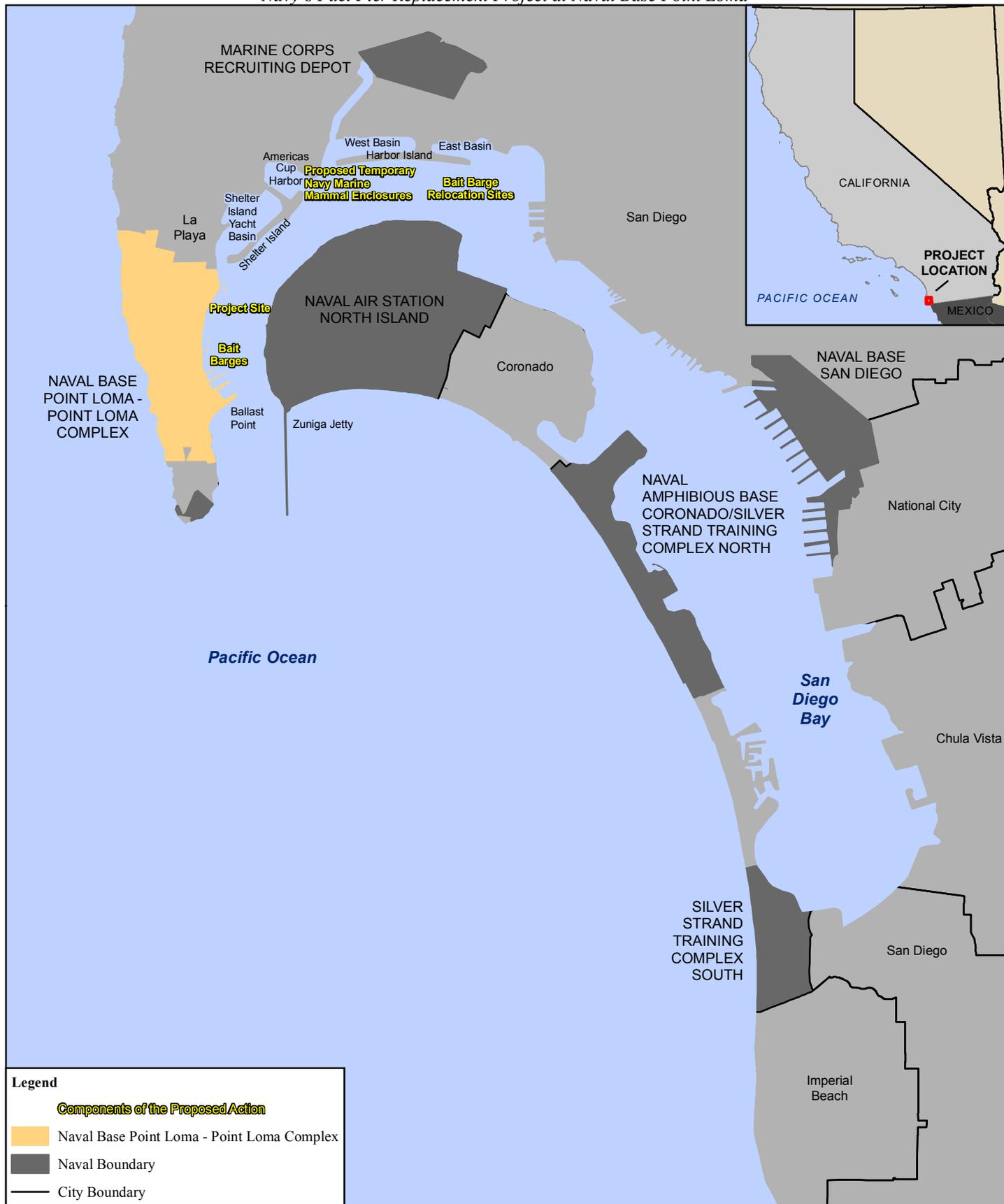


Figure 1-1
Regional Location - Pier 180 Replacement
Naval Base Point Loma - Point Loma Complex



2.0 FUEL PIER REPLACEMENT PROJECT

Refer to the Draft Environmental Assessment (EA) (Navy 2012) and IHA Application (Navy 2013) for a full description of the Fuel Pier Replacement Project.

2.1 Project Area

The project area is in northern San Diego Bay (Figure 2-1) and extends from the fuel pier north and south to eastward along the Point Loma peninsula; across the bay and along the opposite (North Island) side; southward to just outside the mouth of the bay; and eastward into the north-central part of the bay.

2.2 Activities to be Monitored During the First IHA

Activities which would be subject to acoustic and/or marine mammal monitoring include the following.

- Concrete pile driving necessary to construct temporary facilities for the Navy's Marine Mammal Program at the Naval Mine and Antisubmarine Warfare Center (NMAWC). Approximately 50 18-in square concrete piles would be driven with an impact hammer.
- Indicator Pile Program (IPP), comprising approximately 12 steel pipe indicator piles (36-in and 48-in diameter, exact mix not yet determined) to be driven by both vibratory and impact pile driver. This monitoring phase will be used to validate the threshold (ZOI) contours established during the Transmission Loss Modeling.
- Construction of temporary mooring dolphin, including vibratory and impact driving of approximately 16 36-in steel piles.
- Initial construction of new fuel pier, including vibratory and impact driving of approximately 50 36- to 48-in steel piles.
- Initial in-water demolition of existing fuel pier, with the removal of approximately 109 piles, possibly including use of a vibratory pile extractor and/or pneumatic chipper.

Concrete pile driving at NMAWC is not expected to result in harassment, but hydroacoustic and marine mammal monitoring will be performed to 1) verify underwater sound levels; 2) assure that pile driving does not occur when marine mammals are within the ZOI for potential Level B harassment; and 3) refine acoustic monitoring methodologies and deployment strategies proposed for the IPP. Data collection and analysis methods will be consistent with recent NMFS (2012) recommendations. Hydroacoustic measurements will be made for multiple driven piles to characterize the variability in source levels and distances to the MMPA disturbance threshold of 160 dB re 1 μ Pa (root mean square [rms]). These data will then be used to guide marine mammal monitoring which will continue throughout the pile driving activity.

Hydroacoustic and marine mammal monitoring would be conducted for the IPP. Multiple piles will be monitored to assess the variability in source levels and distances to critical isopleths. Given a robust data set from the IPP, hydroacoustic monitoring may be reduced in subsequent steel pile driving (to be covered under subsequent IHAs) because the IPP data will be used to refine the locations of critical isopleths for marine mammal monitoring (see below).

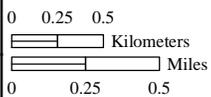


Figure 2-1
Fuel Pier Replacement Project Area



For the IPP, a combination of a fixed and approximately six vessel-based acoustic monitoring stations would be deployed. The fixed station will monitor sources level with continuous, high speed (300 KHz) sampling of underwater acoustic levels, approximately 10 m from the piling, taking into account NMFS (2012) guidance. The hydrophones on vessels will sample acoustic levels at mid depth at various sites for extended periods (e.g. 30 minutes during vibratory and impact pile driving) via Larson Davis sound recorders. Sound measurements of similar pile driving activities taken throughout the vicinity of the fuel pier will be used to determine the approximate locations of the 190/180, 160 and 120 dB isopleths. These isopleths will determine the relevant ZOIs and spatial extent of the marine mammal monitoring program. Vessel-based stations would include one next to the NAS North Island shoreline by Pier Bravo, two each to the east and south across the 160/120 dB isopleth (disturbance thresholds for impact/vibratory pile driving), and one examining conditions within the large buffer zone between the injury and disturbance isopleths. The locations will vary depending on whether impact or vibratory driving is occurring (Section 3). The specific number, locations, and methods of deployment would vary based on the modeled isopleths, measured results, and local knowledge of suitable locations that avoid conflict with Naval or civilian activities.

For vibratory pile extraction and use of the pneumatic chipper, which are also treated as continuous sounds, multiple sets of hydroacoustic measurements will be made for each different type of pile being removed. Per NMFS (2012), dB rms source levels will be measured by taking 10 sec averages during each continuous cycle of activity, and averaging the data across all 10 sec periods. In parallel, four vessel-based monitoring stations, two to the east and two to the south, will collect sound data along transects moving away from the project site to empirically determine the point at which sound from the equipment is either less than 120 dB re 1 μ Pa (the disturbance threshold) or becomes indistinguishable with respect to ambient. It is expected that based on the data collected during the IPP and comparison to the modeling data, the ZOI's for Level B may change. If so, these changes will be reflected in the Project's monitoring alignment.

Airborne sound source measurements will be taken at approximately 15 m from the source. A single mobile airborne monitoring station would also be established in the nearshore area of NBPL to measure distances to the threshold sound levels for pinniped harassment by airborne sound; these are 100 dB re 20 μ Pa rms (unweighted) for sea lions and 90 dB re 20 μ Pa rms (unweighted) for harbor seals. The same individual(s) collecting acoustic data will also be searching for and documenting any occurrences of pinnipeds within these ZOIs. Airborne acoustic measurements will be made for several iterations of each different type of pile installation or removal activity.

Table 2-1 summarizes the in-water construction and demolition activities scheduled to take place during the timeframe covered by the first IHA. The dredging of a turning basin at the pier and the beneficial reuse of the dredged sediments, as discussed further in the EA (Navy 2012), do not have the potential to cause takes of marine mammals and are not proposed to be monitored. Descriptions of pile installation and removal activities follow below.

Table 2-1. Activity Summary, First IHA Application

<i>Activity/Method</i>	<i>Location and Timing</i>	<i># Days</i>	<i>Pile Type</i>	<i># Piles Installed</i>	<i># Piles Removed</i>
Guide pile driving	NMAWC, Sep-Oct 2013	16	18" square concrete	50	
Indicator pile driving	NBPL new pier footprint, Mar 2014	17	36" and 48"-dia steel pipe	12	
Temporary mooring dolphin pile driving	NBPL approx. 150 ft southwest of existing fuel pier, Mar 2014	5	36" dia-steel pipe	16	
Abutment pile driving	NBPL new pier shoreline, Mar-Apr 2014	13	48"-dia steel pipe	24	
Structural pile driving	NBPL new pier footprint, Mar-Apr 2014	15	36" and 48"-dia steel pipe	26	
Total piles installed				128	
Dredging with hopper or clamshell bucket dredge	NBPL Turning basin 1, 200 ft east of fuel pier, Oct-Dec 2013	90	n/a	n/a	n/a
Piles dry pulled with barge-mounted crane	NBPL old pier north segment-new pier footprint, Mar-Jul 2014	4 ¹	16"- square concrete fender		8
Piles dry pulled with barge-mounted crane	NBPL old pier north segment-new pier footprint, Mar-Jul 2014	4 ¹	24"-in square concrete fender		6
Piles cut at mudline	NBPL old pier north segment, Mar-Sep 2014	4 ¹	16"- square concrete fender		4 ²
Piles cut at mudline	NBPL old pier north segment, Mar-Sep 2014	4 ¹	12" dia timber		91 ²
Total piles removed/cut (see Notes)					109²
Extraction with clamshell dredging bucket	NBPL old pier north segment, Mar-Sep 2014	5 ¹	5'-6" or 7'-0" concrete-filled steel caisson		7 ²

Notes: " = inches; ' = feet; dia = diameter; # = number

¹Pile and caisson demolition/removal are estimated to require use of vibratory extraction and/or pneumatic chipper, generating underwater sound, on approximately one-fourth (21 days total) of the above-water demolition time (84 days). This is included as a contingency in the event other methods of extraction are unsuccessful. This IHA only covers work through April 2014. The subsequent IHA application would address the resumption of work in September 2014.

²Contractor could cut up to this number of piles at mudline and remove up to this number of caissons depending on workload and approval under the California least tern MOU during March-April 2014. Piles/caissons not demolished under this IHA would be demolished outside the least tern foraging season under the subsequent IHA application.

2.2.1 Project Pile Installation

The Navy estimates that the contractor will drive approximately 2 steel piles per day, and 5 concrete or fiberglass piles per day. Each pile is assumed to require up to 2 hours of driving. Steel piles would be driven initially with a vibratory pile driver, and then finished as necessary with an impact pile driver. Working assumptions are 1-1.5 hours of vibratory pile driving and up to 0.5 hour of impact pile driving for each steel pile. Concrete and fiberglass piles would be

jettted then driven with an impact pile driver only; sound levels are much lower (estimated as 173 dB re 1 μ Pa rms at 10 m) for these types of piles. Soft start¹ procedures would be employed throughout the first IHA period.

Pile installation could involve the use of a range of equipment; for example, vibratory drivers may range in power from equipment such as an American Pile Driving Equipment (APE) 200 (4,400 inch-pound) to an APE 400 (13,000 inch-pound), and/or an APE 600 (20,000 inch-pound) vibratory driver. Impact hammers used in this project may also vary, for example, from hammers such as the APE D80 (231,000 foot-pound) and/or APE D100 (288,400 foot-pound) impact hammer, or other equivalent equipment. The pile driving conditions encountered, as well as the size of the pile being driven, would determine the specific equipment to be used. The variation in power for the pile driving equipment is not expected to substantively influence the sound pressure levels produced during pile installation/removal activities (WSDOT 2005). Other factors such as pile materials and size, subsurface conditions, and propagation parameters at the project site would likely override any influence from the machinery.

2.2.2 Project Pile Removal

Demolition of the north segment of the pier is scheduled to begin in 2014 within the window of this IHA application. This work is estimated to comprise 84 days, beginning as early as March 2014. Most of the demolition scheduled during this IHA application timeframe would fall within the least tern foraging season, so the work would consist of mainly above-water demolition: removal of the deck hardware, the deck itself and the underdeck. Limited in-water work would occur in accordance with the least tern season avoidance plan. Concrete fender piles (eight 16-in square and six 24-in square) would be removed from the footprint of the proposed new pier to allow installation of piles for the proposed new pier. The fender piles would be dry-pulled only, no vibratory or jettted removal would occur. Fender piles could be removed concurrently with the above- water work or after. Depending on work load during March and April 2014, the contractor could proceed with north pier segment in-water demolition and cut up to 4 concrete piles at the mudline. Up to 7 concrete-filled steel caissons could be removed in this time period as well. The caisson elements could be removed with a barge-mounted derrick crane. The crane can be used to grasp and lift large components such as caissons and piles with attachments such as wire slings or clamshell buckets (i.e., dredge buckets). When a wooden pile cannot be completely pulled out, the wood piles (up to 91 wood piles for this application) could be cut at the mudline using crane-attached hydraulic jaws and/or a diver-operated underwater chainsaw.

¹ Soft-start procedures, in which vibratory and impact driver energy levels are gradually increased from low to high, are believed to allow time for fish and wildlife to move away from the pile driving site before the highest noise levels are produced. The sequence of the soft-start procedures for the Fuel Pier Replacement Project includes a minor deviation from those typically requested by the NMFS which utilize a longer waiting period (one minute vs. 30 seconds). Results from the Test Pile Program and EHW-1 project monitoring in Puget Sound indicated a one minute wait period may be too long. Longer breaks between the sounds may be interpreted by the animals as a transient sound and may not serve the intended purpose to provide an indication that louder sounds are about to begin. The Navy consulted with NMFS regarding using a shorter waiting period (i.e. 30 seconds) and the Service found the Navy's reasoning to be valid and accepted the requested modification. For the Fuel Pier Replacement Project, the soft starts for vibratory hammers require initial starts of 15 seconds at reduced energy followed by a 30-second waiting period. This measure is repeated two additional times. The soft starts for impact hammers require one dry fire followed by a 30-second waiting period. This procedure is repeated two additional times.

2.3 Activities to be Monitored under Subsequent IHAs

The Navy will apply for subsequent IHAs to cover in-water construction and demolition during the September to April work windows. Activities to be monitored under subsequent IHAs would include the continuing removal of the existing pier structure, and the installation of steel structural piles, steel mooring dolphin piles, and concrete and fiberglass-concrete fender piles. Each subsequent IHA application will update the estimated numbers and types of piles to be installed based on the final pier design and progress made during the previous IHA period(s).

3.0 ACOUSTIC MONITORING

3.1 Objectives

The primary purpose of acoustic monitoring is to empirically verify modeled injury (“shutdown”) and behavioral disturbance (“buffer”) zones for marine mammals. These zones are defined by the thresholds established by NMFS. Each zone encompasses the area within the underwater or airborne isopleth. The Navy has committed to a shutdown of pile driving when any marine mammal is present within the injury zone. See definitions below.

a. Underwater Injury (Shutdown) Zones

The underwater injury (shutdown) zone includes the area within the 180 dB rms (see footnote²) re 1 μ Pa isopleth for cetaceans; and within the 190 dB rms re 1 μ Pa isopleth for pinnipeds.

b. Airborne Injury Zones

There is no airborne injury threshold for marine mammals; only a behavioral disturbance threshold discussed below.

c. Underwater Behavioral Disturbance (Buffer) Zones

The behavioral disturbance zone includes the area within the 160 dB rms re 1 μ Pa isopleth for marine mammals during impact pile driving, and the 120 dB rms re 1 μ Pa isopleth for marine mammals during vibratory pile driving; the latter may be adjusted upward based on ambient sound levels that exceed the threshold, subject to concurrence from NMFS. With the exception of concrete pile driving at NMAWC, shutdowns are not required when animals are within these zones, but behavior is recorded (see Section 4.0).

d. Airborne Behavioral Disturbance (Buffer) Zone

The distance to marine mammal disturbance thresholds would be measured. These are currently 90 dB rms re 20 μ Pa (unweighted) for harbor seals and 100 dB re 20 μ Pa rms (unweighted) for all other pinnipeds. Shutdowns are not required within the airborne zones.

Empirical monitoring data will also be used to measure transmission loss for comparison with the site-specific model prepared for the project site as well as the “practical spreading loss” rate of $15 \log (R_2/R_1)$ where R_1 is the reference distance at which the sound level is measured (typically 10 m under field conditions), and R_2 is the distance to the far-field receiver.

The Navy will conduct acoustic monitoring for impact driving of steel piles in order to determine the actual distances to the 160 dB, 180 dB and 190 dB re 1 μ Pa rms isopleths;. The Navy will also conduct acoustic monitoring for vibratory pile driving and extraction, including use of the pneumatic chipper, to determine the actual distance to either the 120 dB re 1 μ Pa rms isopleth or the point at which the rms sound level from the equipment diminishes to the median ambient

² For impact pile driving, rms is calculated over the period of the pulse that contains 90% of the acoustical energy (typically the time interval between 5 percent and 95 percent). For vibratory pile driving, rms refers to the sound pressure level of the signal averaged over 10 seconds of continuous operation.

SPL (rms) at which point it becomes indistinguishable from background noise. The monitoring plan addresses both underwater and airborne sounds.

3.2 Methods

The acoustic component of this monitoring plan was developed by the Navy taking into consideration the logistical, environmental, and security requirements for working in the project area. The monitoring plan has been designed to avoid conflict with the many military and non-military activities that occur continually in San Diego Bay. Monitoring locations will avoid the federal navigation channel and other primary routes of vessel transit. Hydroacoustic monitoring will include continuous monitoring at a location at approximately 10 m (or other distance per NMFS 2012) and shorter time series, vessel-based monitoring at various fixed distances and directions from the site of the pile driving, in order to calculate the approximate locations of the 190/180, 160, and 120 dB sound level isopleths. Vessel-based platforms are preferred because the mobility of the vessels allows for acoustic measurements to be collected at multiple locations thus improving the validation of the transmission loss model and accurately predicting locations of the critical isopleths that define thresholds for harassment. Vessel platforms conducting acoustic monitoring will also be used by marine mammal monitors.

Acoustic monitoring includes the following components.

- The acousticians on the vessels will be in contact with the Principal Investigator at the project site so that the acoustic data can be correlated with periods when the pile driver or extractor is operated.
- Hydroacoustic monitoring will be conducted for each different type of pile and each different method of installation and removal. Monitoring will occur across a representative range of locations with special attention given to the 120, 160, and 180 dB ZOI contours. The resulting data set will be analyzed to provide a statistically robust characterization of the sound source levels and transmission loss associated with different types of pile driving and removal activities. With NMFS' concurrence, for the second IHA application, these metrics will be used to recalculate the limits of injury and disturbance zones, and to make corresponding adjustments in marine mammal monitoring of these zones.
- For underwater recordings, hydrophone systems with the ability to measure real time SPLs will be used in accordance with NMFS most recent guidance (NMFS 2012) for the collection of source levels.
- For airborne recordings, to the extent that logistics and security allow, reference recordings will be collected at approximately 50 ft (15.2 m) from the source via a sound meter with integrated microphone placed on a tripod 5 feet above the ground. Other distances may also be utilized to obtain better data if the signal cannot be isolated clearly due to other sound sources (i.e., barges or generators). If from a distance other than 50 ft, the source data would be converted to the 50-ft distance based on simple spherical spreading.
- Hydrophones will be placed ~10 m from the source and within the ZOIs to their predicted eastern and southern limits. An integrated DGPS will record the location of individual acoustic records. A depth sounder or weighted tape measure will be used to determine the

depth of the water. The hydrophone will be attached to a weighted line to maintain a constant depth.

- Each hydrophone (underwater) and microphone (airborne) will be calibrated at the beginning of each day of monitoring activity. Pressure and intensity levels will be reported relative to 1 μPa and 1 μPa^2 , respectively.
- For each monitored location, a hydrophone will be deployed at mid-depth in order to evaluate site specific attenuation and propagation characteristics.
- In order to determining the area encompassed by the 190, 180, 160, and 120 dB rms isopleths for marine mammals, hydrophones will collect data at various distances from the source to measure attenuation throughout the ZOIs.
- Ambient conditions, both airborne and underwater, would be measured at the same monitoring locations but in the absence of project sound to determine background sound levels. Ambient levels are intended to be recorded over the frequency range from 7 Hz to 20 kHz. Ambient conditions will be recorded for at least 1 minute every hour of the work day, for at least one week of each month of the period of the IHA.
- Sound levels associated with soft-start techniques will also be measured but will be differentiated from source level measurements.
- Airborne levels would be recorded as unweighted, as well as in dBA and the distance to marine mammal injury and behavioral disturbance thresholds, also referred to as shutdown and buffer zones, would be measured.
- Environmental data would be collected including but not limited to: wind speed and direction, air temperature, humidity, surface water temperature, water depth, wave height, weather conditions and other factors that could contribute to influencing the airborne and underwater sound levels (e.g., aircraft, boats, etc.);
- The Principal Investigator would supply the acoustics specialist with the substrate composition, hammer model and size, hammer energy settings and any changes to those settings during the piles being monitored, depth of the pile being driven, and blows per foot for the piles monitored.
- For acoustically monitored piles, data from the continuous monitoring locations (~10m and ~450 m from source) will be post-processed for sound level signals and will include frequency spectra between 7 Hz and 20 kHz; determination of absolute peak overpressure and under pressure levels recorded for each pile; average, minimum, and maximum rms values; for each absolute peak pile strike, the rise time, average duration of each pile strike, number of strikes per pile, Sound Exposure Level (SEL) of the absolute peak pile strike, mean SEL, and cumulative SEL (Accumulated SEL = single strike SEL + $10 \cdot \log$ (# hammer strikes); and a frequency spectrum for up to eight successive strikes with similar sound levels.

3.3 Acoustic Measurement Locations

Considering the phased approach to the Fuel Pier construction activities and the range and complexity necessitating sound monitoring data, three separate sound monitoring methodologies

will be deployed. During initial pile driving activities (concrete piles) required for relocation of the Marine Mammal Program to NMAWC, acoustic monitoring will be conducted from a continuous stationary platform approximately 10 m from the source and at various fixed locations from a vessel-based platform (Figure 3-1). Vessel-based acoustic monitoring will be conducted near the predicted harassment isopleth in an attempt to bracket the ZOI edge during pile driving events and will support marine mammal monitoring. Owing to the relatively low sound levels associated with driving concrete piles at this location, the single platform will be sufficient to monitor both the shutdown and buffer zones. As detailed in the IHA application, the buffer zone for concrete pile driving at this location is estimated to extend 74 m from the source (Navy 2013).

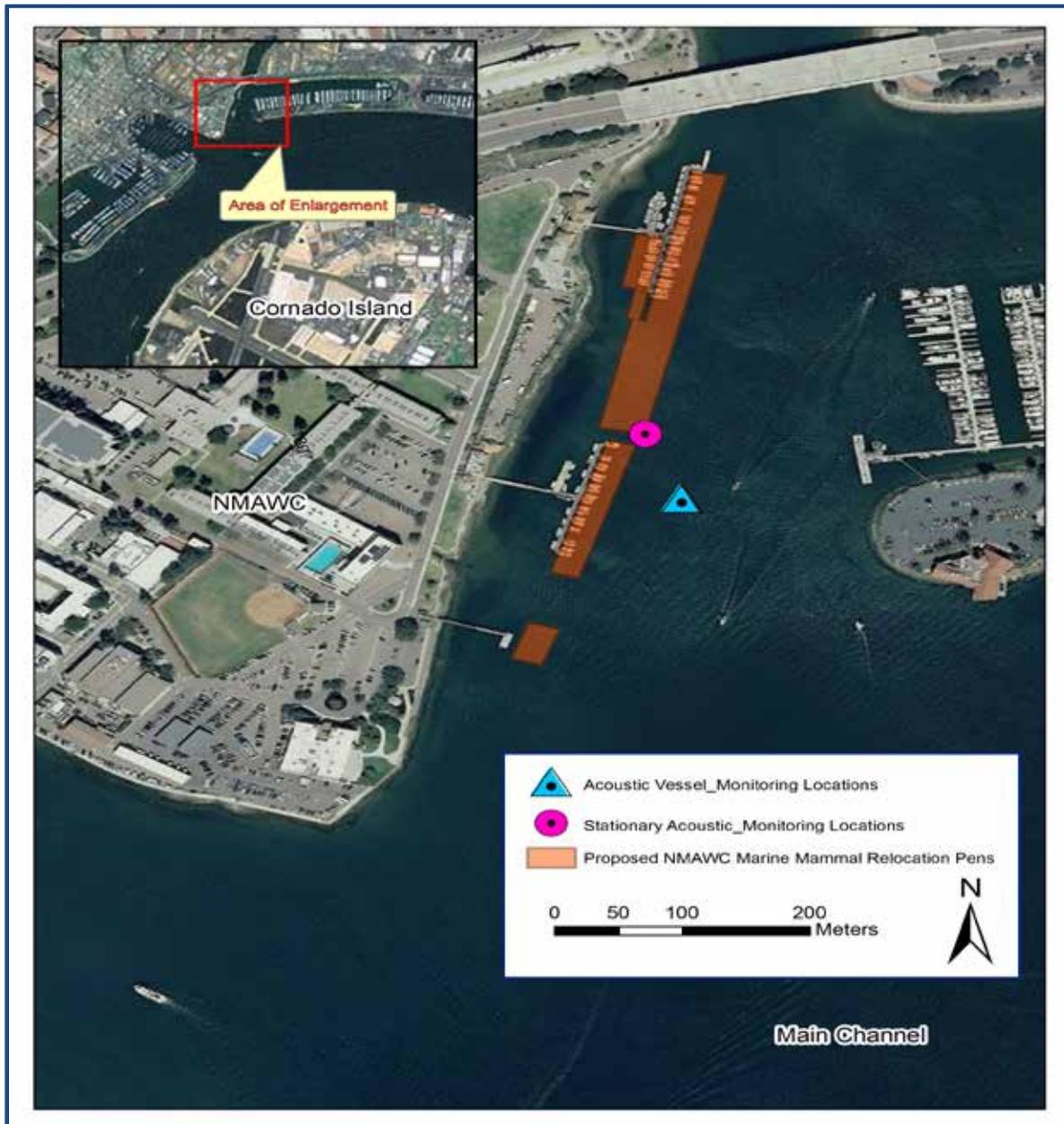


Figure 3-1 Notional Monitoring Locations at NMAWC

During the IPP and for any additional steel pile driving that occurs within the initial IHA period, as well as removal activities involving vibratory extractor or pneumatic chipper use, hydroacoustic monitoring stations are proposed to be located approximately in the areas shown in Figure 3-2. The locations are at ~10 m from the source and along radial transects outward from the construction site across predicted isopleths that coincide with the limits of the shutdown (injury) and buffer (behavioral harassment) zones. Variation to these positions may occur due to logistical or security constraints, or based on the best professional judgment of the acoustics contractor in order to utilize the best positions to obtain the necessary data.

3.4 Acoustic Data Collection Equipment and Hydrophones

The acoustic data collection systems utilized for the recording of sound levels from the various locations will differ depending on the construction activities. All sound data acquisition will utilize equipment used during the pre-project study evaluating ambient sound within the bay. Stationary platforms will employ National Instruments (NI) multi-channel data acquisition system (NI-DAQ) integrated with a high speed (300 kHz) NI analog to digital board, analog high impedance charge amp made by Bruel & Kjaer Instruments, and two spherical hydrophones (Reson TC-4033), deployed at mid depth at each station (Table 3-1). The spherical hydrophones have a low noise floor and a high dynamic range. Additionally, Larson Davis (LD) 831 Class 1 integrated sound meters will be used to record and observe both in water real time SPL's and airborne sound data. The sound meter is equipped with data logging firmware capable of recording continuous SPL's initial GPS position, and display of real time sound levels in 1/1 and 1/3 -octave bands. The sound meter utilizes a detachable LD microphone to collect airborne sound levels.

For IPP as well as vibratory extraction and pneumatic chipping of piles at the fuel pier, a fixed continuous hydroacoustic monitoring system will be positioned on a barge or pontoon boat anchored or secured to the pier or other support structure, approximately 10 m (or an appropriate distance, if different, based on NMFS 2012) from the pile being driven or removed. The fixed hydrophones will provide a continuous recording of the pile being driven and display the SPL in real time throughout the monitoring period. Additional systems will be deployed from anchored vessels at various locations along the predicted outer limits of the behavioral ZOI for impact pile driving (160 dB re 1 μ Pa [rms]), to the northeast near Harbor Island, and to the southeast (offshore) near the termination of Zuniga Jetty. Vessel based hydroacoustic monitoring systems will be deployed in multiple locations along the predicted behavioral ZOI's to validate the modeled ZOI and reposition marine mammal monitors if needed.

During vibratory pile driving and removal activities, sound data will be collected near the predicted 120 dB isopleth of the buffer zone to the northeast and southeast. These vessels will attempt to record the SPL generated by the continuous sound source at the project site, moving to successive locations farther from the source. Once this distance or isopleth is identified it will become the outer limit at which behavioral disturbance associated with vibratory pile driving or extraction will be monitored by marine mammal monitors. The acousticians on the vessels will be in contact with the Principal Investigator at the project site so that the acoustic data can be correlated with periods when the pile driver or extractor is operated.



Figure 3-2 Notional Monitoring Locations for the IPP, Vibratory Extraction and Pneumatic Chipping

Vessels will also serve as marine mammal monitoring platforms and an observer will be stationed on each vessel during all in-water construction activities. After the completion of the acoustic monitoring period, these vessels will remain on-site for the duration of the project to continue providing support to the marine mammal monitoring effort.

Sound level meters (SLMs) will be used to display an approximate real time output of the sound pressure levels received by the hydrophone. Acousticians in the field would use this display to note the instantaneous values during the event and estimate the instantaneous rms level. Reporting of actual sound pressure levels will be based on continuously recorded data at source and vessel recordings post-processed at the end of the recording period

For impact pile driving, the SLM will provide an estimate of the pulse rms because they are based on a fixed time constant (the impulse setting of the SLM is 35 milliseconds) whereas the rms for impact pile strikes is based on the duration of the pulse, which is usually 50 to 70 milliseconds. The real-time display from the SLM will slightly overestimate the pulse rms. For vibratory sounds, the SLM will provide a direct measurement as 1-second rms or SEL value. The fixed hydrophone measuring source level will be connected to a high-speed recording device which will record the raw data for post-processing and can be used to compare against the estimated "real-time" results indicated on the SLM.

During all vessel-based recordings, the engine and any depth sounders must be off. The vessel goes temporarily silent and is moored or anchored. The spot recordings will be made and the hydrophone pulled back on board the vessel. GPS positions will be logged for each recording position. Then the vessel will move to another location. All other vessel-based hydrophones are "spot recordings." The duration of the spot recordings will be determined by the acoustician in the field and based on current site conditions and type of pile driving activity occurring but are anticipated to be on the order of 30 minutes at each location.

3.5 Equipment

Table 3-1 provides examples of the type of equipment that may be used to monitor underwater and airborne sound pressure levels. All applicable equipment will have NIST traceable calibration.

Table 3-1. Sound Monitoring Equipment

Item	Make	Model
Sound Data Acquisition Systems	National Instruments	DAQ
Sound Analog to Digital Signal Converters	National Instruments	
Sound Analysis Software	National Instruments	LabView
Sound Level Meters	Larson Davis	LD 831
Firmware Interval Logging	Larson Davis	LD Log
Firmware 1/1 & 1/3 Octave Analysis	Larson Davis	831-OB3
Firmware GPS integration	Larson Davis	831-GPS
Hydrophones	Reson	TC-4033
Analog High Impedance Charge Amp	Bruel & Kjaer	2635
Pistiphone, HI Pressure, 134dB @ 250 Hz	ETMC Technologies	42AC

4.0 MARINE MAMMAL MONITORING

4.1 Observer Qualifications and Procedures

Monitoring will be conducted by qualified, trained marine mammal observers (MMOs). An observer is a biologist with prior training and experience in conducting at-sea marine mammal monitoring or surveys, and who has the ability to identify marine mammal species and describe relevant behaviors that may occur in proximity to in-water construction activities. A trained observer will be placed at the best vantage point(s) practicable to monitor for marine mammals and implement shutdown/delay procedures when applicable by calling for the shutdown to the hammer operator. The observers will have no other construction related tasks while conducting monitoring.

A dedicated monitoring coordinator will be on-site during all construction days. The monitoring coordinator will oversee the environmental monitoring staff including all acousticians and MMOs. The monitoring coordinator will serve as the liaison between the environmental monitoring staff and the construction contractor to assist in the distribution of information.

4.2 Methods

The Navy will monitor the shutdown zone and buffer zone before, during, and after pile driving and removal. Based on NMFS requirements, the Marine Mammal Monitoring Plan would include the following procedures:

- MMOs would be located at the best vantage point(s) in order to properly see the entire shut down zone and safety zone. This may require the use of a small boat to monitor certain areas while also monitoring from one or more land based vantage points;
- During all observation periods, observers would use binoculars and the naked eye to search continuously for marine mammals;
- Monitoring distances will be measured with range finders;
- Impact driving of steel piles would be curtailed under conditions of fog or poor visibility that would obscure the presence of a marine mammal within the shutdown zone;
- The shutdown and safety zones around the pile will be monitored for the presence of marine mammals before, during, and after any pile driving or removal activity;
- Pre-Activity Monitoring:
 - o The shutdown and buffer zones will be monitored for 15 min prior to in-water construction/demolition activities. If a marine mammal is present within or approaching the shutdown zone, the activity would be delayed until the animal(s) leave the shutdown zone. Activity would resume only after the MMO has determined, through sighting or by waiting approximately 15 min that the animal(s) has moved outside the shutdown zone. The MMO will raise a green flag and radio the monitoring coordinator/construction contractor when construction activities can commence.
- During Activity Monitoring:
 - o The shutdown and buffer zones will also be monitored throughout the time required to drive and remove piles. If a marine mammal is observed entering the buffer

zone, a “take” would be recorded and behaviors documented. However, that pile segment would be completed without cessation, unless the animal enters or approaches the shutdown zone, at which point the MMO will raise a red flag and radio the monitoring coordinator/construction contractor that all pile driving and extraction activities are to be halted as soon as it is safe to do so. Pile driving can only resume once the animal has left the shutdown zone of its own volition or has not been re-sighted for a period of 15 min, at which point the MMO will raise a green flag and radio the monitoring coordinator/construction contractor that activities can resume.

- Post-Activity Monitoring: Monitoring of the shutdown and buffer zones would continue for 15 min following the completion of the activity.

4.3 Data Collection

NMFS requires that at a minimum, the following information be collected on sighting forms used by MMOs:

- Date and time that pile driving or removal begins or ends;
- Construction activities occurring during each observation period;
- Weather parameters identified in the acoustic monitoring (e.g., wind, humidity, temperature);
- Tide state and water currents;
- Visibility;
- Species, numbers, and if possible sex and age class of marine mammals;
- Marine mammal behavior patterns observed, including bearing and direction of travel, and if possible, the correlation to SPLs;
- Distance from pile driving activities to marine mammals and distance from the marine mammal to the observation point;
- Locations of all marine mammal observations;
- Other human activity in the area.

The required fields will be incorporated into an electronic form that will be used by the Navy's MMOs. To the extent practicable, the MMOs will also record behavioral observations that may make it possible to determine if the same or different individuals are being “taken” as a result of project activities over the course of a day.

4.4 Equipment

The following equipment will be required to conduct marine mammal monitoring:

- Survey boats (with elevated observation points) will include: a fixed marine radio for the Captain to communicate on Ch. 16 and other marine channels independent of observers communicating on a dedicated channel, depth finder, measuring tape, navigational plotting equipment, and both fixed and hand-held GPS Units. Vessels will comply with all Coast Guard regulations and be able to pass a Coast Guard safety inspection;

- Hearing protection for biologists and boat operators within the airborne impact injury zone;
- Portable marine radios and headsets for the observers to communicate with the monitoring coordinator, construction contractor, and other observers;
- Cellular phones, (one per boat/observing location), and the contact information for the other observers, monitoring coordinator, and NMFS point of contact;
- Green flags (one per boat/observing location) as back-up for radio communication;
- Red flags (one per boat/observing location) as back-up for radio communication;
- Nautical charts;
- Daily tide tables for the project area within the Hood Canal;
- Watch or Chronometer;
- Binoculars with built-in rangefinder or reticles – (quality 7 x 50 or better);
- Monitoring plan, IHA permit, and/or other relevant permit requirement specifications in sealed clear plastic cover;
- Notebook with pre-standardized monitoring Marine Mammal Observation Record forms on non-bleeding paper (e.g Rite-in-the Rain);
- Marine mammal identification guides on waterproof paper
- Clipboard
- Pen / Pencil

4.5 Shutdown and Buffer Zones

The acoustic modeling results presented within the Draft Environmental Assessment and the request for an Incidental Harassment Authorization were used to develop the shutdown zones for pile installation activities associated with the Fuel Pier Replacement Project. The shutdown zones were created to delineate areas in which marine mammals may be exposed to injurious underwater sound levels due to pile driving and extraction, or to other hazards associated with construction and demolition. Marine mammal monitoring will also occur for additional areas beyond the shutdown zone, referred to as the buffer zone, where sound pressure levels may cause harassment.

For all in-water construction and demolition activities, a minimum protective shutdown zone of 10 m is proposed. Sound-generating activities with larger shutdown zones are as follows, based on the maximum modeled distance to the Level A (injury) threshold:

- During impact driving steel piles (36- or 48-inch), the shutdown distance for pinnipeds will initially be 36 m, and the shutdown distance for cetaceans will initially be 452 m.
- During vibratory pile driving, the shutdown distance will initially be 14 m.

All shutdown zones will initially be based on the distances from the source which were predicted for each threshold level. However, in-situ acoustic monitoring will be utilized to determine the actual distances to these threshold zones, and the size of the shutdown zones will be adjusted

accordingly (increased or decreased) based on received sound pressure levels. The Navy will use attended hydrophones and SLM to record the vibratory and impact pile driving signals. Given the time required for processing the acoustic data sets and the need for follow-up discussions with NMFS, the Navy recognizes that revisions to the shutdown zones may be proposed as part of subsequent IHA applications. In the event of substantial discrepancies between modeled and measured sound levels, the Navy may contact NMFS to propose and discuss appropriate changes in monitoring.

The limits of the buffer zone subject to monitoring are also a function of the pile driving or extraction activity. The outer limits of the buffer zone would be defined by the point at which the measured SPL (maximum rms) produced by the equipment either declines to 160 dB in the case of pile driving, or, for continuous noise sources, to 120 dB re 1 μ Pa or below the median background level, contingent on NMFS approval.

4.6 Observer Monitoring Locations

In order to effectively monitor the shutdown zones, marine mammal observers (MMOs) will be positioned at the best practicable vantage point(s), taking into consideration the behavior of marine mammal species like to enter the buffer zone, security, safety, and space limitations at the NBPL waterfront, in order to properly monitor these zones. Observers may be stationed in small vessels or on one of the piers at locations that will provide adequate visual coverage for the marine mammal shutdown and buffer zones.

Notional monitoring locations were shown previously in Figure 3-1. One observer will be placed at a suitable location around the active pile driving rig in order to observe the respective shutdown zones for vibratory and impact pile driving. The observer's monitoring would be primarily dedicated to observing the shutdown zone; however, they would record all marine mammal sightings beyond these distances provided it did not interfere with their effectiveness at carrying out the shutdown procedures. Additionally, three vessel-based monitoring platforms, from which acoustic monitoring will also be conducted, will be positioned to monitor the buffer zones, one to the south, one to the northeast, and one covering the space in between, respectively, of the fuel pier for vibratory and impact pile driving/removal activities. The observers associated with these platforms would also record all visible marine mammal sightings beyond the buffer zone. The acousticians on board will be noting SPLs in real-time, but will not communicate that information immediately to the MMOs in order to avoid biasing the observations. These platforms will move closer to or farther from the source depending on whether received SPLs are less than or greater than the disturbance threshold values.

During pile driving for relocation of the Marine Mammal Program to NMAWC, marine mammal monitoring will be conducted from a single vessel-based platform, from which acoustic monitoring will also be conducted. Owing to the relatively low SPLs associated with driving concrete piles at this location, the single platform will be sufficient to monitor both the shutdown and buffer zones. As detailed in the IHA application, the buffer zone for concrete pile driving at this location is estimated to extend only 74 m from the source (Navy 2013).

All MMOs will be in radio communication with each other so that the MMOs will know when to anticipate incoming marine mammal species and when they are tracking the same animals observed elsewhere.

4.7 Interagency Notification

The Navy anticipates that monitoring/shutdown zones may be modified as a result of acoustic data obtained during the monitoring period, and to reflect other conditions relating to construction activities and marine mammal species occurrence. This is anticipated to occur during the second IHA period, but in the event that the Navy needs to immediately modify terms of this monitoring plan (e.g., if source levels and measured isopleths differ substantially from modeled results), the NMFS representative will be promptly contacted for discussion of the requested modification.

In addition, if the Navy finds an injured, sick, or dead marine mammal, the Navy will notify NMFS immediately. All of these marine mammal sightings will be called into the NMFS Stranding Coordinator for the Southwest, Sarah Wilkin (562-980-3230), unless the marine mammal's condition is a direct result of the project, in which case additional notification should be made to Ben Laws (NMFS HQ) (301-427-8425). The Navy will provide NMFS with the species or description of the animal(s), the condition of the animal (including carcass condition if the animal is dead), location, the date and time of first discovery, observed behaviors (if alive), and photo or video (if available).

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

5.0 REPORTING

A draft report would be submitted to NMFS within 45 calendar days of the completion of acoustic measurements and marine mammal monitoring. The results would be summarized in graphical form and include summary statistics and time histories of sound values for each pile. A final report would be prepared and submitted to the NMFS within 30 days following receipt of comments on the draft report from the NMFS. At a minimum, the report shall include:

- General data:
 - Date and time of activities.
 - Water conditions (e.g., sea-state, tidal state).
 - Weather conditions (e.g., percent cover, visibility).
- Specific pile data for acoustically monitored piles:
 - Description of the activities being conducted.
 - Size and type of piles.
 - The machinery used for installation or removal.
 - The power settings of the machinery used for installation or removal
- Specific acoustic monitoring information:
 - A description of the monitoring equipment.
 - The distance between hydrophone(s) and pile.
 - The depth of the hydrophone(s).
 - The physical characteristics of the bottom substrate where the piles were driven or extracted (if possible).
 - Acoustic data (per Section 3 above) for each monitored pile and activity.
- Pre-activity observational survey-specific data:
 - Dates and time survey is initiated and terminated.
 - Description of any observable marine mammal behavior in the immediate area during monitoring.
 - If possible, the correlation to underwater sound levels occurring at the time of the observable behavior.
 - Actions performed to minimize impacts to marine mammals.
- During-activity observational survey-specific data:
 - Description of any observable marine mammal behavior within monitoring zones or in the immediate area surrounding monitoring zones.
 - If possible, the correlation to underwater or airborne sound levels occurring at the time of this observable behavior.
 - Actions performed to minimize impacts to marine mammals.

- Times when pile extraction is stopped due to presence of marine mammals within the shutdown zones and time when pile driving resumes.
- Post-activity observational survey-specific data:
 - Results, which include the detections of marine mammals, species and numbers observed, sighting rates and distances, behavioral reactions within and outside of safety zones.
- A refined take estimate based on the number of marine mammals observed during the course of construction.

6.0 REFERENCES

- Navy. 2012. Draft Environmental Assessment, Naval Base Point Loma (NBPL) Fuel Pier Replacement and Dredging (P-151/DESC1306) San Diego, California. Prepared by Naval Facilities Engineering Command, Southwest.
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- NMFS (National Marine Fisheries Service). 2012. Memorandum from NMFS Northwest Region and Northwest Fisheries Science Center to Interested Parties. Subject: Guidance Document: Data Collection Methods to Characterize Impact and Vibratory Pile Driving Source Levels Relevant to Marine Mammals. 31 January.
- WSDOT (Washington State Department of Transportation). 2005. Underwater sound levels associated with restoration of the Friday Harbor Ferry Terminal. Prepared for Washington Department of Transportation. May 2005.