Application for National Marine Fisheries Service Incidental Harassment Authorization for the Trinidad Pier Renovation, Trinidad, CA

Applicant: Cher-Ae Heights Indian Community of the Trinidad Rancheria

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1. Description of the specific activity or class of activities that can be expected to result in incidental taking of marine mammals

Background

The Trinidad Pier is the northernmost oceanfront pier in California and has been used for commercial and recreational purposes over the last 50 years. Trinidad harbor and pier serve a fleet of commercial winter crab fishermen and year-round water angling for salmon, and nearshore/finfish species. Trinidad Pier was first built by Bob Hallmark in 1946. Since that time only minor maintenance activities have occurred on the pier. Today, Trinidad's economy is based on fishing and tourism and the pier supports these activities. The pier also provides educational opportunities by accommodating the HSU Telonicher Marine Lab's saltwater intake pipe, and the California Center of Integrated Technology's (CICORE) water quality sonde. Currently, the Trinidad Rancheria plays an important role in the economic development of the Trinidad area through three main business enterprises, one of which is the Sea Scape Restaurant and the pier. The Cher-Ae Heights Indian Community of the Trinidad Rancheria (Trinidad Rancheria) is a federally-recognized tribe composed of descendants of the Yurok, Weott, and Tolowa peoples. In 1906 a congressional action authorized the purchase of small tracts of land for landless homeless California Indians. Through this federal authority, 60 acres of land was purchased on Trinidad Bay to establish the Trinidad Rancheria. In 1917 the Secretary of the Interior formally approved the Trinidad Rancheria as a Federally Recognized Tribe.

The community began developing in the 1950's. In January 2000, Trinidad Rancheria purchased the Trinidad Pier, harbor facilities and the Seascape Restaurant. The Rancheria leases a total area of 14 Acres in Trinidad Bay from the City of Trinidad. The Trinidad Rancheria currently operates the pier, and upland improvements including a boat launch ramp and the SeaScape Restaurant. Funds for permitting and designs of the pier were granted to the Trinidad Rancheria by the California State Coastal Conservancy.

The purpose of the Trinidad Pier Reconstruction Project is to correct the structural deficiencies of the pier and improve pier utilities and safety for the benefit of the public, and indirectly improve the water quality conditions and provide additional habitat for the biological community in the ASBS. Currently it is difficult to ensure the continued safety of the pier due to excessive deterioration of the creosote-treated Douglas fir piles and the pressure treated decking.

Project Location

The proposed project is located in Trinidad Bay, on the coast of northern California (41.0555°N, 124.1472°W; Figure 1 on page 15). It is a shallow, open bay about 0.5 mile deep (in the southwest-northeast direction) and 1 mile wide (in the northwest-southeast direction). Figure 1 shows substantially the whole bay. The southeastern extent of the bay is not clearly shown on the USGS or NOAA maps and charts examined for this study, but the topographic function implied by the word “bay” does not have much of an effect on wind, waves, currents, or habitat at distances of more than about a mile southeast of the pier.

Water depths (in feet) are shown in Figure 2 (page 18). Generally the bay shelves at a moderate slope to about 30 feet depth and then flattens out, with most of the outer bay between 30 and 50 feet deep. Substrates in the bay include rock, cobble, gravel and sand. The floor of the bay is irregular with some areas of submerged rock.

Pier Construction Overview

Summary plans for the pier and staging area are presented in Appendix A. Pier improvements are proposed to replace at a one-to-one ratio, the approximately 13,500 ft^2 of pre-cast concrete decking. In addition the project includes 110 cast-in-steel-shell (CISS), polyurea-coated batter and moorage piles (18 inches in diameter), 53 plastic fender piles (10 inches in diameter) footed in the mud and secured to the dock where hoists and ladders are located, four hoists, standard lights, guardrail, and dock utility pipes including water, power, and telephone. A new storm water collection system will also be incorporated into the reconstructed pier design. The CISS piles will be separated at 5 ft intervals along 25 ft-long concrete bents. A total of 22 bents separated 30 ft apart (25 ft apart in the outer 100 feet of the dock) shall be used. The decking of the new pier will be constructed of pre-cast 20 ft-long concrete sections. The new pier will be 540 ft long and 24 to 26 ft wide, corresponding to the existing footprint.

A pile bent will be installed at the existing elevation of the lower deck to provide access to the existing floating dock. The existing stairs to the lower deck will be replaced with a ramp that is ADA compliant. The decking of the pier will be constructed at an elevation of 21.0 ft above Mean Lower Low Water (MLLW). The top of the decking will be concrete poured to create a slope for drainage and to incorporate a pattern and a color into the concrete surface in order to provide an aesthetically pleasing appearance. An open guardrail, 42 inches in height shall be constructed of tubular galvanized steel rail bars (approximately 3/4 inch diameter) uniform in shape throughout the length of pier. Lighting will be installed in the decking (and railing in the landing area) along the length of the pier and will be focused and directed to minimize lighting of any surfaces other than the pier deck.

Currently there are four hoists on the pier. Three of the hoists are used to load and unload crab pots from the pier and the fourth hoist located at the end of the pier is suited to load and unload skiffs. The hoists are approximately 30 years old and may have had the Yale motors replaced since the time they were installed. The hoists shall be re-installed at points corresponding to their current location and their current duties.

All design specifications shall conform to the Uniform Building Code.

Pier Demolition Methods

Removal of the existing pier and construction of the new pier shall occur simultaneously. Construction shall begin from the north (shore) end of the pier. All pier utilities and structures shall first be removed. Utilities to be removed include water, electrical, power and phone lines, temporary bathroom, ladders and pier railing. Structures to be removed include four hoists, two wood sheds, HSU's 20hp (14.9kW) pump and saltwater intake pipes, CICOREs' water quality sonde, and a concrete bench. Then the existing pressure treated decking, joists, and bent beams shall be removed and transported by truck to the upland staging area for temporary storage.

Existing piles located in the section of pier being worked on (active construction area) will then be removed by vibratory extraction. Vibratory extraction is a common method for removing both steel and timber piling. The vibratory hammer is a large mechanical device mostly constructed of steel that is suspended from a crane by a cable. The vibratory hammer is deployed from the derrick and positioned on the top of the pile. The pile will be unseated from the sediment by engaging the hammer and slowly lifting up on the hammer with the aid of the crane. Once unseated, the crane will continue to raise the hammer and pull the pile from the sediment. When the bottom of the pile reaches the mudline, the vibratory hammer will be disengaged. A choker cable connected to the crane will be attached to the pile, and the pile will be lifted from the water and placed upland. This process will be repeated for the remaining piling. Extracted pilings will be stored upland, at the staging area, until the piles are transferred for upland disposal. Each such extraction will require approximately 40 minutes of vibratory hammer operation, with up to five piles extracted per day (a total of 3.3 hours per day).

Douglas-fir pilings are prone to breaking at the mudline. In some cases, removal with a vibratory hammer is not possible because the pile will break apart due to the vibration. Broken or damaged piling can be removed by wrapping the individual pile with a cable and pulling it directly from the sediment with a crane. If the pile breaks between the waterline and the mudline it will be removed by water jetting.

A floating oil containment boom surrounding the work area will be deployed during creosote-treated timber pile removal. The boom will also collect any floating debris. Oil-absorbent materials will be deployed if a visible sheen is observed. The boom will remain in place until all oily material and floating debris has been collected. Used oil-absorbent materials will be disposed at an approved upland disposal site. The contractor shall also follow BMPs: NS-14 – Material Over Water, NS-15 – Demolition adjacent to Water, and WM-4 – Spill Prevention and Control listed in the CASQA Handbook.

The existing Douglas-fir piles are creosote treated. The depth of creosote penetration into the piles varies from 0.25 to 2 inches. Creosote is composed of a mixture of chemicals that are potentially toxic to fish, other marine organisms and humans. Polycyclic aromatic hydrocarbons (PAH), phenols and cresols are the major chemicals in creosote that can cause harmful health effects to marine biota. The replacement of the creosote treated piles with cast-in-steel-shell (CISS) concrete piles is expected to eliminate potential contamination of the water column by PAH, phenols and cresols from the existing treated wood piles.

All removed piles shall be temporarily stored at the upland staging areas until all demolition activities are complete (approximately 6 months). Following the cessation of demolition activities, the creosote treated piles will be transported by the Contractor to Anderson Landfill in Shasta County. This landfill is approved to accept construction demolition, wood wastes, and nonhazardous/nondesignated sediment.

The pressure treated 2 × 4 inch Douglas-fir decking will also be stored at the staging area until demolition is complete. The partially pressure treated decking and railing may be reused and will be kept by the Trinidad Rancheria for potential future use.

Pile Installation

Design

Two 18-inch diameter battered piles, which are designed to resist lateral load, will be located on each side of the pier at 12:1 slopes. Three vertical piles, which are designed to support 50 tons of vertical loads, will be located between the battered piles separated 5 ft apart.

Overview

New piles will be installed initially from shore and then, as construction proceeds, from the reconstructed dock. Following removal of each existing pile, a steel casings will be vibrated to a depth of approximately 2.5 ft above the tip elevation of the proposed pile (25-35 ft below the mud line). The steel shell of ¾ inch thickness shall extend from above the water surface to below the upper layer of sediment, which consists of sand, into the harder sediment, which consists mostly of weathered shale and sandstone. The steel shell will be coated with a polymer to protect the casings from corrosion. The steel shell shall be used to auger the holes and will then be cleaned and concrete poured using a tremie to seal the area below the shell. The shell will then be dewatered and a steel rebar cage installed prior to pouring concrete to fill the shell. These steps are described in further detail below.

Pile Excavation

Following installation of the steel casing, each hole will be augered to the required pile depth of 25-35 ft below the mud line. An auger drill shall be used to excavate the sediment and rock from the steel shell. Geotechnical studies (Taber 2007) indicate that the materials encountered in the test borings, consisting of a layer of mud over partially decomposed shale and sandstone bedrock, can be excavated using typical heavy duty foundation drilling equipment.

Steel casing members of ¾ inch thickness shall be used to form the CISS concrete foundation columns in underwater locations. In this technique, inner and outer casings are partially imbedded in the ground submerged in the water and in concentric relationship with one another. The annulus formed between the inner and outer casings is filled with water and cuttings, while the inner casing is drilled to the required depth, and the sediment is removed from the core of inner steel casing. Following removal of the core, the outer casing is left in place as the new pile shell.

The sediment and cuttings excavated shall be temporarily stockpiled in 50 gallon drums (or another authorized sealed waterproof container) at the staging area until all excavations are complete and then transferred for upland disposal at the Anderson Landfill or another approved upland sediment disposal site.

The existing piles extend to approximately 20 ft. below the mud line. Each one of the existing 12-inch diameter pile has displaced 15.7 ft^3 of sediment. There are approximately 205 wood piles to be removed. The total amount of sediment displaced by the existing piles is approximately 120 yd^3. Each of the proposed CISS piles requires the displacement of approximately 53 ft^3 of sediment. There are 115 CISS piles to install. A total of approximately 225 yd^3 of sediment would have to be removed in order to auger 115 holes to a depth of 30 ft. below the mudline. It is estimated that 10 -100 yd^3 would have to be removed during pile installation. Many new holes will be augered in the location of existing piles where they overlap. As a result, less sediment will be required to be removed as would be required for the construction of a new pier, however, the exact location and penetration of the old piles is not recorded and will be determined during reconstruction activities. Therefore, a range of quantity of material to be removed is specified. Existing holes created by old wood piles removed and that do not overlap with the location of holes augered for the new piles will collapse and naturally fill with adjacent sediment.

Most of the sediment excavated is expected to be in the form of cuttings if the hole is augered and/or drilled at a location of exiting piles. Sediment removed from the inner core during augering shall be mostly dry due to the compression created in the core during augering. Approximately 50 - 50 gallon drums will be used to store the cuttings and sediment prior to disposal upland. The contractor shall implement BMPs WM-3 – Stockpile Management, WM-4 – Spill Prevention and Control, and WM-10 – Liquid Waste Management listed in the CASQA Handbook (see handbook for detail).

Concrete Seal Installation

A tremie will be used to seal the bottom 3 ft. of the hole below the bottom of the steel shell and above the ground. Before the tremie seal is poured, the inside walls of the pile will be cleaned by brushing or similar method of any adhering soil or debris to improve the effectiveness of the seal. A “cleaning bucket” or similar apparatus will be used to clean the bottom of the excavation of loose or disrupted material.

The tremie is a steel pipe long enough to pass through the water to the required depth of placement. The pipe is initially plugged until placed at the bottom of the holes in order to exclude water and to retain the concrete, which will be poured. The plug is then forced out and concrete flows out of the pipe to its place in the form without passing through the water column. Concrete is supplied at the top of the pipe at a rate sufficient to keep the pipe continually filled. The flow of concrete in the pipe is controlled by adjusting the depth of embedment of the lower end of the pipe in the deposited concrete. The upper end may have a funnel shape or a hopper, which facilitates feeding concrete to the tremie. Each concrete seal is expected to cure within 24-48 hours.

Dewatering Methodology

After the tremie seal has been poured, the water will be pumped out of the steel shells, which will act as a cofferdam. Pumping within the excavation at the various footings may be required to maintain a dewatered work area.

The contractor shall test the pH of the water in each casing one day following pouring of the tremie seal to insure that the pH of the water did not change from the ambient pH. The water shall then be pumped into 50-gallon drums and transported to the staging area for discharge through percolation to eliminate solids. Should the pH of the water change from ambient pH, then the contractor shall haul the water to the Eureka Wastewater Treatment Plant for treatment prior to discharge. The contractor is expected to dewater a volume of approximately 450 gallons (1,720 L) each day during pile installation. For the installation of 115 piles, approximately 49,500 gallons (197,800 L) will be dewatered and discharged at the appropriate location at the staging area. Percolation rates will be verified prior to discharge of the ocean water at the designated location at the staging area, but are not expected to be prohibitive due to the sandy texture of the soil. The Contractor shall implement BMP WM-10 Liquid Waste Management as listed in the CASQA Handbook. Liquid waste management procedures and practices are used to prevent discharge of pollutants to the storm drain system or to watercourses as a result of the creation, collection, and disposal of non-hazardous liquid wastes. WM-10 provides procedures for containing liquid waste, capturing liquid waste, disposing liquid waste, and inspection and maintenance.

Completion

Following dewatering of the steel shells, steel rebar cages shall be inserted into each shell. Ready-mix concrete placed into the drilled piers shall be conveyed in a manner to prevent separation or loss of materials. The cement-mixer truck containing the concrete shall be located on land adjacent to the north end of the pier. The concrete shall be pumped to the borings through a pipe (at least ¾ inch thick) that will span the length of the pier. When pouring concrete into the hole, in no case shall the concrete be allowed to freefall more than 5 ft. (1.5m). Poured concrete will be dry within at least 24 hours and completely cured within 30 days.

A concrete washout station shall be located in the staging area at the designated location. The contractor shall implement BMP, WM-8 – Concrete Waste Management, as listed in the CASQA Handbook to prevent discharge of liquid or solid waste.

Pier Deck Construction

Following the installation of the concrete piles, pre-cast concrete bent caps measuring 25 ft. (7.6m) - long shall be installed on top of each row of pilings. The concrete bents act to distribute the load between the piles and support the pier.

Pre-cast 20 ft. (6.1m) - long concrete sections shall be used for the decking. An additional layer of concrete shall be poured following installation of the precast sections. The layer of concrete will allow the decking of the pier to be sloped to the west for drainage purposes and to create an aesthetically pleasing decking. The surface of the decking will be colored and contain an earth tone pattern to match the surrounding environment.

Utilities

Utilities located on the pier will require relocation during construction and replacement following construction of the pier footings and decking. Utilities include:

Power: A 2-inch PG&E power line that is currently attached to the west side of the pier and PG&E electrical boxes located along the west side of the pier.

Sewer: Currently there are no sewer pipes on the pier. Visitors to the pier are served by nearby restrooms at the Seascape Restaurant. No direct sewer discharge is allowed in the ASBS.

New utilities installed include water, phone and electrical. New pier utilities will be constructed along the east and west side of the pier and will be enclosed within concrete utility trenches. Water pipes shall be routed along both sides of the pier to several locations along the pier. Phone lines shall be routed along the west side of the pier. All electrical switches will be located in one central box towards the west end of the pier by the loading and unloading landings location.

Lighting installed along the pier shall be designed to improve visibility and safety. The proposed lighting will be embedded in the decking and railing of the pier to minimize light pollution from the pier. Lighting shall be designed to minimize light pollution by preventing the light from going beyond the horizontal plane at which the fixture is directed. Currently, there are lighting poles on the pier. The proposed lighting on the pier will be embedded on the west and east side of the decking separated approximately 25 ft. (7.6m) throughout the length of the pier. The lighting fixtures will have cages for protection matching the color of the railing. In addition, on the south side of the pier, lighting will be installed in the railing to provide lighting for the working area on the deck of the pier.

Fish cleaning does not occur at the pier. This activity was formerly pursued by recreational users and was discontinued in 2006 due to water quality concerns.

Drainage

There is currently no runoff collection system on the pier. Runoff drains from the existing pier directly into the ASBS. A storm water outfall for the City of Trinidad is located near the base of the pier.

The pier decking shall be sloped to the west in order to direct runoff from the pier to the stormwater collection pipe. The runoff shall be routed along the west side of the pier and conveyed by gravity to a new upland manhole and storm chamber containing treatment media. All stormwater will be infiltrated within the storm chamber; there will be no discharge from the system. See Appendix A, drawings C-6 to C-9, for details of the conveyance and treatment system.

Project Best Management Practices & Mitigation

Mitigation and best management practices (BMPs) are summarized below and described in greater detail in the foregoing text. These measures include all formal mitigation detailed in the Mitigated Negative Declaration for the project. The complete statement of measures that appears in the Mitigated Negative Declaration is attached to this document as Appendix B.

Mitigation Measures

Timing constraints for underwater noise

To minimize noise impacts on marine mammals and fish, underwater construction activities shall be limited to the period when the species of concern will be least likely to be in the project area. The construction window for underwater construction activities shall be August 1 to May 1.

Implementation Assurance: Provide NMFS advance notification of the start dates and end dates of underwater construction activities.

Marine Mammal Monitoring

Marine mammal monitoring and reporting shall be performed consistent with procedures to be directed by NMFS in the terms of an active biological opinion, incidental harassment authorization, and/or other written conditions placed on the proposed action. Such conditions have not yet been placed but are provisionally anticipated to include the following terms:

- An observer trained in identification of marine mammals shall attend the project site one hour prior until one hour after construction activities cease each day throughout the construction window.
- Activities requiring a marine mammal observer shall only be performed between one-half hour after sunrise, and one-half hour before sunset. Visibility is a limiting factor during much of the winter in Trinidad. Shut-downs during times of fog could well result in prolonging the construction period into the beginning of the pupping season for harbor seals. Accordingly, activities shall proceed at any time that conditions allow clear visual observation of the area within 100 feet of the pier.
- The observer shall be approved by NMFS.
- The observer shall search for marine mammals within behavioral harassment threshold areas to be identified by NMFS but provisionally identified as including areas within the acoustic effect thresholds identified in Section 6, extending up to 2425 feet from the noise-generating activity, depending on the type of noise being generated.
- Should marine mammals other than harbor seals be identified within the threshold area while underwater construction activities are occurring, the

observer shall notify the Project Engineer who will notify the Contractor, who shall stop work until the affected species have not been sighted within the behavioral harassment threshold area for 30 minutes.

- Whenever a construction halt is called due to marine mammal presence in the area, the Project Engineer (or their representative) shall immediately so notify the designated NMFS representative.
- If harbor seals are sighted by the observer within the acoustic threshold areas, the observer shall record the number of seals within the threshold area and the duration of their presence while the noise-generating activity is occurring. The observer will also note whether seals appeared to respond to the noise and if so, the nature of that response. These observations will be reported to NMFS in a letter report to be submitted on each Monday, describing the previous week's observations.
- All sightings of marine mammals other than harbor seals will be similarly recorded and documented, and will be included in the weekly letter report.

Implementation Assurance: Monitoring logs submitted to the NMFS.

Underwater Noise Monitoring

Underwater noise monitoring and reporting shall be performed consistent with conditions of Coastal Development Permit 1-07-046. Those conditions are here summarized:

“PRIOR TO COMMENCEMENT OF DEMOLITION AND CONSTRUCTION AUTHORIZED BY COASTAL DEVELOPMENT PERMIT NO. 1-07-046, the applicant shall submit a Hydroacoustic Monitoring Plan, containing all supporting information and analysis deemed necessary by the Executive Director for the Executive Director’s review and approval. Prior to submitting the plan, to the Executive Director, the applicant shall also submit copies of the Plan to the reviewing marine biologists of the California Department of Fish & Game and the National Marine Fisheries Service for their review and consideration.

“At a minimum, the Plan shall:

“(1) Establish the field locations of hydroacoustic monitoring stations that will be used to document the extent of the hydroacoustic hazard footprint during vibratory extrication or placement of piles or rotary augering activities, and provisions to adjust the location of the acoustic monitoring stations based on data acquired during monitoring, to ensure that the sound pressure field is adequately characterized;

“(2) Describe the method of hydroacoustic monitoring necessary to assess the actual conformance of the proposed vibratory extrication or placement of piles or rotary augering with the dual metric exposure criteria in the vicinity of the vibratory extrication or placement of piles or rotary augering locations on a real-time basis, including relevant details such as the number, location, distances, and depths of hydrophones and associated monitoring equipment;

“(3) Include provisions to continuously record noise generated by the vibratory extrication or placement of piles or rotary augering in a manner that enables continuous and peak sound pressure and other measures of sound energy per strike, or other information required by the Executive Director in consultation with marine biologists of the California Department of Fish & Game and the National Marine Fisheries Service, as well as provisions to supply all monitoring data that is recorded, regardless of whether the data is deemed “representative” or “valid” by the monitor (accompanying estimates of data significance, confounding factors, etc. may be supplied by the acoustician where deemed applicable);”

The permit also specifies reporting protocols, to be developed in cooperation with and approved by representatives of the California Coastal Commission, the California Department of Fish & Game, and the National Marine Fisheries Service.

No activities are proposed that would produce sound at Level A harassment levels, however, if underwater noise monitoring at any time indicates noise levels that exceed the Level A harassment threshold in waters more than 10 meters from the activity, the associated activity shall immediately cease and the NMFS project representative will be contacted. The activity shall not recommence without NMFS authorization.

Best Management Practices

Pier Demolition Methods

- Waters shall be protected from incidental discharge of debris by providing a protective cover directly under the pier and above the water to capture any incidental loss of demolition or construction debris.

- A floating oil containment boom surrounding the work area will be used during creosote-treated timber pile removal. The boom will also collect any floating debris. Oil-absorbent materials will be employed if a visible sheen is observed. The boom will remain in place until all oily material and floating debris has been collected and sheens have dissipated. Used oil-absorbent materials will be disposed at an approved upland disposal site.

- All removed piles shall be temporarily stored at the upland staging areas until all demolition activities are complete (approximately 6 months).

- Following the cessation of demolition activities, the creosote treated piles will be transported by the Contractor to an upland landfill approved to accept such materials.

- The pressure treated 2 × 4 inch Douglas-fir decking will also be stored in the staging area until demolition is complete. The partially pressure treated decking and railing may be reused and will be kept by the Trinidad Rancheria for further use.

- The contractor shall also follow BMPs: NS-14 – Material Over Water, NS-15 – Demolition adjacent to Water, and WM-4 – Spill Prevention and Control listed in the CASQA Handbook.

Pile Installation

- The sediment and cuttings excavated shall be temporarily stockpiled in 50 gallon (189L) drums (or another authorized sealed waterproof container) at the staging area until all excavations are complete and then transferred for upland disposal at the Anderson Landfill or another approved upland sediment disposal site.

- The contractor shall implement BMPs WM-3 – Stockpile Management, WM-4 – Spill Prevention and Control, and WM-10 – Liquid Waste Management listed in the CASQA Handbook.

- The contractor shall test the pH of the water in each casing one day following pouring of the tremie seal to insure that the pH of the water did not change by more than 0.2 units from the ambient pH. The water shall then be pumped into 50-gallon drums and transported to the staging area for discharge through percolation to eliminate solids. Should the pH of the water change from ambient pH, then the contractor shall haul the water to the Eureka Wastewater Treatment Plant for treatment prior to discharge.

- The Contractor shall implement BMP WM-10 Liquid Waste Management as listed in the CASQA Handbook. Liquid waste management procedures and practices are used to prevent discharge of pollutants to the storm drain system or to watercourses as a result of the creation, collection, and disposal of non-hazardous liquid wastes. WM-10 provides procedures for containing liquid waste, capturing liquid waste, disposing liquid waste, and inspection and maintenance.

- A concrete washout station shall be located in the staging area at the designated location. The contractor shall implement BMP, WM-8 – Concrete Waste Management, as listed in the CASQA Handbook to prevent discharge of liquid or solid waste.

Pier Construction

- No concrete washing or water from concrete will be allowed to flow into the ASBS and no concrete will be poured within flowing water.

- Waters shall be protected from incidental discharge of debris by providing a protective cover directly under the pier and above the water to capture any incidental loss of demolition or construction debris.

Utilities

- Lighting will be embedded in the decking and railing of the pier to minimize light pollution from the pier. Lighting shall be designed to minimize light pollution by preventing the light from going beyond the horizontal plain at which the fixture is directed so the light is directed upwards.

Drainage

- The pier decking shall be sloped to the west in order to direct runoff from the pier to the stormwater collection pipe. The runoff shall be routed along the west side of the pier and conveyed by gravity to a new upland manhole and storm chamber containing treatment media. Drainage from the storm chamber shall not be conveyed to Trinidad Bay, but will entirely be infiltrated within the storm chamber. See Appendix A, drawings C-5 to C-8, for details.

Construction Timing & Sequencing

- Noise-generating construction activities, including augering, pile removal, pile placement, and concrete pumping, will only be allowed from 7 a.m. to 7 p.m. These hours shall be further restricted as necessary in order for marine mammal observers to perform required observations.

Project Benefits

The existing pier has pole lighting that illuminates the water surface; the proposed pier has lighting designed to avoid such illumination.

The existing pier has dark wood and over 200 piles. The proposed pier, with half as many piles and a white concrete construction, will result in less shading of nearshore habitat.

2. Dates and duration of such activity and the specific geographical region where it will occur

The project is expected to be completed within nine months. Reconstruction of the pier is proposed to commence on August 1, 2011 and terminate on May 1, 2012. Excluding weekends and holidays, a total of 217 working days will be available for work during this period. During the winter months (November to March) severe weather conditions are expected to occur periodically at the project site. The Contractor may have to halt the work during pile installation due to strong winds, large swells, and/or heavy precipitation. Construction during the remainder of the year should not be impeded by large swells, but may be halted due to strong winds or precipitation. The Contractor will work five days per week from 7 a.m. to 7 p.m. Should severe weather conditions cause delays in the construction schedule, the

Contractor will work up to seven days per week as needed to ensure completion by May 1, 2012.

Removal of the existing piles and decking and construction of the new pier will occur simultaneously. The existing decking and piles will be removed and new piles installed from the reconstructed pier. Pile bents will be separated 25 ft. (7.6m) apart. Following the installation of two successive pile bents, a new precast concrete deck section shall be installed. The contractor shall continue in this manner from the north end (shore) to south end (water terminus) of the existing pier.

The contractor is expected to spend approximately six months (August through January) on pile removal and installation and the remaining three months (February through April) on deck and utilities reconstruction. It is estimated that each boring can be lined with a pile and excavated within six to eight hours. Pouring of the concrete seals is expected to take approximately two hours for each pile. The contractor is expected to remove an existing pile and install one new steel shell and pour a concrete seal each day, with a total of six to eight hours required for the process. The final pour of the concrete piles is expected to take approximately two hours to fill the steel shells and is expected to cure within one week.

It is expected that reconstruction of one row of piles and bents will take one week. Pile and bents will be installed over a discontinuous period of approximately 22 weeks. A new pre-cast concrete section of decking will be installed following the installation of two successive rows of piles and associated bents.

The last three months will be used for pouring of the top layer of the decking and utilities construction.

3. Species and numbers of marine mammals likely to be found within the activity area

Gray whales, harbor seals, and California sea lions harbor seals are likely to be found within the activity area. Steller sea lions and transient killer whales could potentially be found in small numbers within the activity area, but harassment authorization is not requested for Steller sea lions and transient killer whales due to their rarity and the feasibility of avoiding impacts to these species by pausing work in the event that they are detected, as detailed in the Marine Mammal Monitoring Plan (Appendix C).

Figure 1. Area of Effect For Underwater Noise.

A variety of other marine mammals have on occasion been reported from the coastal waters of northern California. These include bottlenose dolphins, harbor porpoises, northern elephant seals, northern fur seals, and sea otters. However, none of these species has been reported to occur in the action area, and in particular, none were mentioned by the regional NMFS field specialist in her identification of species to be addressed in the IHA Application. USFWS has informed the Corps of Engineers that a Section 7 consultation is not necessary for any of their jurisdictional species, sea otters included.

Harbor Seals

Goley et al. (2007) details harbor seal abundance at varied sites in Humboldt County, including the haul-out at Indian Beach, which generally refers to beaches in Trinidad Bay. Seals haul out on rocks and at small beaches at many locations that are widely dispersed within the Bay; the closest such haul-out is 70 m from the pier, while the most distant are over 1 km away near the south end of the bay (Dawn Goley pers. comm. 2009.03.23). Seals haul out at rocks in the Bay regularly throughout the year, so seals approaching or departing these haul-outs would be subject to underwater noise from pile driving and thus, potential behavioral modification. The area so affected is shown in Figure 1, which also shows potential exposure in areas that are on a line-of-sight to construction-related noise-generating activities.

Table 7 in Goley et al. (2007) lists the sighting rates for harbor seals during 9 years of monthly observations at Trinidad Bay. A sighting rate of zero occurred only 3 times in a total of 62 observations, and the average number of animals observed per month ranged from a low of 25 in November to a maximum of 67 in July. On four occasions, over 120 seals were counted at the haul-out. The average sighting rate during the period when pile removal and placement would occur, in the months from August through January, was 36.5 seals per monthly observation. In contrast, the average detection rate in the months of February through July was 50.7 seals per monthly observation. In practice, seals can usually be seen and/or heard from the existing pier (Dawn Goley pers. comm. 2009.03.23).

No data were collected on how much time the seals spend in the water near the haul-outs. Goley et al. (2007) note that they "are typically less abundant during the winter months as seals tend to spend more time foraging at sea during this time. Seals are more abundant in the area in spring and summer. During this time both male and females increase their use of near shore habitat for hauling out and feeding (Thompson et al. 1994, Coltman et al. 1997, Van Parijs et al. 1997, Baechler et al. 2002)." From early March to June harbor seals in Trinidad Bay bear and rear pups, and in June and July the seals molt; both activities tie them closely to land and correlate to intensive use of available haul-outs. It is not clear whether seals may disperse to use alternative haul-outs. The Trinidad Bay harbor seal population, which consists of approximately 200 seals, shows very little interchange with the nearby

Humboldt Bay population. However, there is also a much larger population of over 1,000 seals at Patrick's Point, a few miles to the north. It is not known whether seals move back and forth between the Trinidad Bay and Patrick's Point populations. If not, then Trinidad Bay seals are highly dependent upon available haul-outs in Trinidad Bay (Dawn Goley pers. comm.. 2009.03.23).

At the beginning of the construction period, in August, the average number of harbor seals observed at the haul-out is 63.5 (based on one observation of 121 animals and 3 observations of 33 to 52 animals). At this time it is highly probable that harbor seals require frequent use of this haul-out for essential activities such as rearing pups and molting, and that, given the limits on animal mobility imposed by these activities, much activity occurs nearshore within the area affected by pile-driving noise. Thereafter, seal use of the haul-out declines greatly (average of 30.3, 25.2, 32.5 and 27.6 animals recorded in September, October, November, December, and January, respectively), and most foraging occurs in offshore areas unaffected by pile driving noise.

California Sea Lions

California sea lions, although abundant in northern California waters, have seldom been recorded at Trinidad Bay. This may be due to the presence of a large and active harbor seal population there. Any sea lions that did visit the action area during construction activities would be subject to the same type of impacts described above for harbor seals.

Steller Sea Lions

Steller sea lions are migratory and appear to be most abundant in the Humboldt County area during spring and fall. The nearest documented haul-out site for Steller sea lions is Blank Rock, situated approximately 1 km due west of the Trinidad Pier, on the opposite side of Trinidad Head (Figure 2). Surveys have documented absence of Steller sea lions at this haul-out between the months of October through April, and very few have been observed in the months of August and September (Sullivan 1980). Furthermore, when leaving haul-outs, sea lions generally travel seaward to forage in deeper waters where their prey is more abundant (National Marine Fisheries Service 2008). Steller sea lions have not been documented within Trinidad Bay over eight years of surveys conducted at the site (Dr. Dawn Goley, 2008, pers.comm). The areas surrounding the project site could be used by non-breeding adults and juveniles and by sea lions after the breeding season (National Marine Fisheries Service 2006).

Gray Whales

Goley et al. (2007) lists the sighting rates for gray whales during 8 years of monthly observations at Trinidad Bay. Sighting rates varied from 0 to 1.38 whales per hour of observation time. The average detection rate during the period when pile removal and placement would occur, in the months from August through January, was 0.21 whales per hour of observation time. In contrast, the average detection rate in the months of February through July was 0.48 whales per hour. The majority of these detections were within 2 km of the shoreline. Visibility conditions seldom allow detection of whales at greater distances.

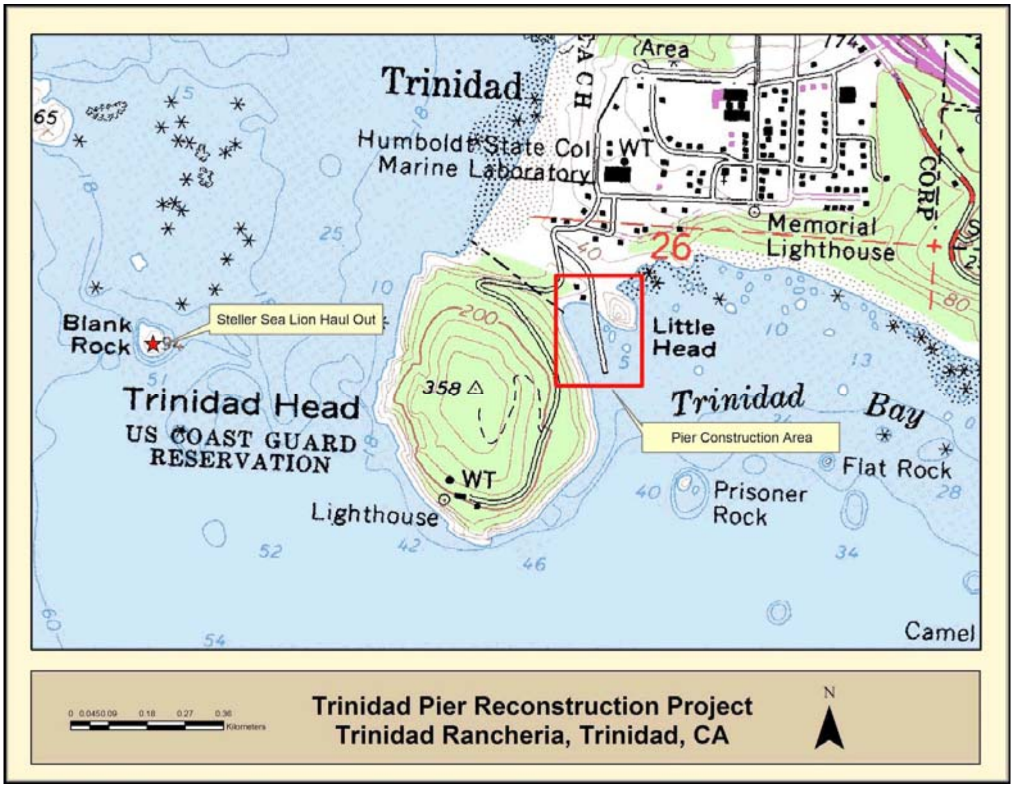

Figure 2. Map showing project location.

Killer Whales

Killer whales are rare visitors to Trinidad Bay, but there is currently a very high awareness of their potential presence due to an incident in May, 2008 when a transient killer whale was observed to take a seal on the beach at Trinidad Bay (Driscoll 2008).

4. Description of the status, distribution, and seasonal distribution of the affected species or stocks of marine mammals likely to be affected

The status, distribution, and seasonal distribution of gray whales, harbor seals and California sea lions is detailed in Section 3, above.

5. Type of incidental taking authorization that is being requested and the method of incidental taking

This is a request for authorization for incidental harassment by acoustic mechanisms which may result in behavioral changes by gray whales, California sea lions, or harbor seals. The authorization is requested to cover activities between August 1, 2011 and January 31, 2012. The acoustic mechanisms involved entail in-air and underwater non-impulsive noise caused by the activities of vibratory pile removal, auger operation, and vibratory pile placement. Anticipated peak underwater noise levels, as detailed below, may exceed the 120 dB RMS level B threshold, but are not anticipated to exceed the 180/190 dB RMS level A threshold for pinnipeds/cetaceans. Expected in-air noise levels are anticipated to result in elevated sound intensities within 500 feet of construction activities involving vibratory pile driving and augering. No other mechanism of effect is expected to affect marine mammal use of the area. The debris containment boom, for instance, would not affect any haul-out and would not entail noise and activity in the water materially different from normal vessel operations at the pier, to which the animals are already habituated. The following sections detail potential acoustic effects.

Underwater Noise

Background

When a pile is vibrated, the vibration propagates through the pile and radiates sound into the water and the substrate as well as the air. Sound pressure pulse as a function of time is referred to as the waveform. The peak pressure is the highest absolute value of the measured waveform, and can be a negative or positive pressure peak (see Table 1 for definitions of terms used in this analysis). The RMS level is determined by analyzing the waveform and computing the average of the squared pressures over the time that comprise that portion of the waveform containing 90 percent of the sound energy (Richardson et al. 1995, Illingworth & Rodkin 2008). This RMS term is described as $RMS_{90\%}$ in this report. In this analysis, underwater peak pressures and RMS sound pressure levels are expressed in decibels re 1µPa; however, in other literature they can take other forms such as a Pascal or pounds per square inch. The total sound energy in an impulse accumulates over the duration of that impulse.

Table 1. Hydroacoustic terminology

Term	Definition
Peak Sound Pressure, unweighted (dB)	Peak sound pressure level based on the largest absolute value of the instantaneous sound pressure. This pressure is expressed in this report as a decibel (referenced to a pressure of 1µPa) but can also be expressed in units of pressure, such as a µPa or PSI.
RMS Sound Pressure Level, (NOAA Criterion), dB re:1µPa	The average of the squared pressures over the time that comprise that portion of the waveform containing 90 percent of the sound energy for one pile driving impulse.
Waveforms, µPa over time	A graphical plot illustrating the time history of positive and negative sound pressure of individual pile strikes shown as a plot of µPa over time (i.e., seconds).
Frequency Spectra, dB over frequency range	A graphical plot illustrating the distribution of sound pressure vs. frequency for a waveform, dimension in rms pressure and defined frequency bandwidth.

Baseline Underwater Noise Level

Currently, no data are available describing baseline levels of underwater sound in Trinidad Bay. Relevant index information can be derived from underwater sound baselines in other areas. The quietest waters in the oceans of the world are at Sea State Zero, 90 dB at 100 Hz (National Research Council 2003, Guedel 1992). Underwater sound levels in Elliott Bay near Seattle, WA, representative of an area receiving moderately heavy vessel traffic, are about 130 dB_{RMS} (WSDOT 2006). In Lake Pend Oreille, ID, an area which, like Trinidad Bay, receives moderate to heavy traffic from smaller vessels, underwater sound levels of 140 dB_{RMS} are reached on summer weekends, dropping to 120 dB_{RMS} during quiet midweek periods (Cummings 1987). Puget Sound and Lake Coeur d'Alene, however, are inland or protected marine waters that are not subject to the severity of wave and storm activity that can occur in the Trinidad area. It is likely that intermittent directional sound sources of higher intensity constitute a part of the normal acoustic background, to which seals in the area are habituated. Assuming that such intermittent background sound sources may be twice as loud as the regionally averaged RMS background of 120 dB, then seals are unlikely to show a behavioral response to any sounds quieter than 126 dB_{RMS}. Accordingly, the action area for underwater sound is defined to include all waters where construction-generated noise levels may exceed 126 dB_{RMS}.

Noise Thresholds

There has been extensive effort directed towards the establishment of underwater sound thresholds for marine life. Various criteria for marine mammals have been established through precedent. Acoustical data are presented in terms of the criteria metrics.

Current NMFS practice[1] regarding exposure of marine mammals to high-level sounds is that cetaceans and pinnipeds exposed to impulsive sounds of 180 and 190 dB_{RMS} or above, respectively, have the potential to be injured (i.e., Level A harassment). NMFS considers the potential for behavioral (Level B) harassment to occur when marine mammals are exposed to sounds below injury thresholds but at or above 160 dB_{RMS} threshold for impulse sounds (e.g., impact pile driving) and 120 dB_{RMS} threshold for continuous noise (e.g., vibratory pile driving). Since, as noted above, background sound levels in Trinidad Bay are anticipated to frequently exceed the 120 dB_{RMS} threshold, this analysis evaluates potential effects relative to a background of 126 dB_{RMS}.

Extent of Underwater Project Noise

Pile Driving

There are several sources of measurement data for piles that have been driven with a vibratory hammer. Illingworth & Rodkin (2008) collected data at several different projects with pile sizes ranging from 13-inch to 72-inches. The most representative data from these measurements would be from the Ten Mile River Bridge Replacement Project[2] and the Port of Anchorage Marine Terminal Redevelopment Project. At Ten Mile, ninety-six 30-inch CISS piles were measured in cofferdams filled with water in the Ten Mile River at 33 feet and 330 feet from the piles. The sound level in the water channel ranged from <150 to 166 dB_{RMS}. Levels generally increase gradually with increasing pile size. These sound levels are, therefore, considered a conservative (credible worst case) estimate of the expected levels given that the size of the piles proposed for this project are smaller in diameter (18 in.) than the piles measured at Ten Mile.

Illingworth & Rodkin (2008) gathered data at the Port of Anchorage during the vibratory driving of steel H piles. These data, and data gathered by others, were used as the basis for the Environmental Assessment (EA) that was prepared by NMFS for the issuance of an incidental harassment authorization (IHA). These data were summarized in the IHA. The Port of Anchorage IHA concluded that average sound levels of vibratory pile driving sounds would be approximately 162 dB re:1µPa at a distance of 20 meters. Furthermore, for vibratory driving, the 120 dB level would be exceeded out to about 2,625 feet from the vibratory hammer.

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[1] Environmental Assessment on the Issuance of an Incidental Harassment Authorization and Subsequent Rule Making for Take of Small Numbers of Marine Mammals Incidental to the Port of Anchorage Terminal Redevelopment Project, Anchorage, Alaska, prepared by National Marine Fisheries Service, July 2008.

[2] Memos from K, Pommerenck (Illingworth & Rodkin, Inc.) to Lisa Embree of Caltrans dated 4/25/2007 through 8/28/2007 transmitting underwater noise measurement results for CISS piles at Bents 5, 6, 7 and 8 of the Ten Mile River.

A selection of additional projects using vibratory hammers was made from the "Compendium of Pile Driving Sound Data" (Illingworth & Rodkin 2007). This includes all projects in the compendium that used a vibratory hammer to drive steel pipe piles or H-piles. Data from these projects, and the two projects named above, are summarized in Table 2.

Table 2. Sound Level Data

Project	Distance	Pile type	Water depth	RMS dB re:1µPa
10 Mile	33 feet	30-inch steel pipe	not stated	166
10 Mile	330 feet	30-inch steel pipe	not stated	<150
Port of Anchorage	66 feet	H-pile	not stated	162
San Rafael Canal	33 feet	10-inch H-pile	7 feet	147
San Rafael Canal	66 feet	10-inch H-pile	7 feet	137
Mad River Slough	33 feet	13-inch steel pipe	16 feet	154 to 156
Richmond Inner Harbor	33 feet	6-foot steel pipe	not stated	167 to 180
Richmond Inner Harbor	66 feet	6-foot steel pipe	not stated	163 to 164
Richmond Inner Harbor	98 feet	6-foot steel pipe	not stated	160
Stockton Wastewater Crossing	33 feet	3-foot steel pipe	not stated	168 to 175
Stockton Wastewater Crossing	66 feet	3-foot steel pipe	not stated	166
San Rafael sea wall	33 feet	10-inch H-pile	7 feet	147
San Rafael sea wall	66 feet	10-inch H-pile	7 feet	137

Source: Illingworth & Rodkin (2007, 2008).

Based on these data, the results for 30-inch to 3-foot steel pipe driven in water would appear to constitute a conservative representation of the potential effects of driving 18-inch steel pipe at the Trinidad Pier. Those indicate an RMS level of 166 to 175 dB at 33 feet from the pile. Calculations in this analysis assume the high end of this range. For this analysis, close to the pile, it is assumed that there would be a 4.5 dB decrease for every doubling of the distance. Isopleth distances based on this inference are presented in Table 3. Figure 1 shows both the area of effect and the relative exposure risk based on the presence of shielding features (headlands and sea stacks). Under no circumstances would the Level A (injury) threshold for cetaceans or pinnipeds be exceeded, but all activities would exceed background sound level of 126 dB_{RMS}, throughout Trinidad Harbor. Shielding by headlands flanking the harbor would, however, prevent acoustic impacts to waters outside the harbor that are not on a line-of-sight to the sound source. This effect is shown in Figure 1.

Noise Levels from Augering

An attempt was made to measure the noise from augering out the 30-inch piles at the Ten Mile Bridge Replacement Project. The levels were below the peak detector of the equipment, 160 dB_{peak}, and so measurements were stopped. Based on this the levels for augering the 18-inch piles would be below 160 dB_{peak} and thus below approximately 150 dB_{RMS}. Augering is expected to generate noise levels at or below the lower end of this range (Illingworth & Rodkin 2008). Using the uniform spreading model transmission loss rate of 4.5 dB per doubling of distance, background sound levels would be exceeded at distances of less than 1.5 miles (Table 3).

Table 3. Predicted Distances to Acoustic Threshold Levels for the Trinidad Pier Reconstruction

Construction Activity	Distance from activity to Isopleth			
	190 dB	180 dB	160 dB	126 dB
18" pile vibratory installation	3 ft	16 ft	333 ft	14.5 miles
Augering	0 ft	1 ft	33 ft	1.5 miles
Wood Pile Removal	0 ft	3 ft	71 ft	3.1 miles

Noise Levels from Removal of Wood Piles

Removal of the existing wood piles would be accomplished with the use of a vibratory hammer. Typically the noise levels for installing and removing a pile are approximately the same when a vibratory hammer is used. The noise generated by installing wood piles is generally lower than steel shell piles. Illingworth & Rodkin has had only one opportunity to measure the installation of woodpiles and this was with a 3,000-pound impact hammer. The levels measured at a distance of 10 meters were as follows: 172 - 182 dB_{peak}, 163 - 168 dB_{RMS}. For a comparable CISS pile, using a 3,000-pound drop hammer, the levels measured were 188 - 192 dB_{peak}, 172 - 177 dB_{RMS}. The noise generated during the installation of the wood pile was approximately 10 dB lower than the CISS piles. Following this logic, the sound produced when removing the wood piles would be about 10 dB lower than when installing the CISS piles.

Levels of 180 dB_{RMS} or 190 dB_{RMS} are not expected to occur in the water as a result of pile removal. Peak sound pressures would not be expected to exceed 190 dB in water. The average sound level of vibratory woodpile removal would be approximately 152 dB re:1µPa at a distance of 66 feet. Using the uniform spreading model transmission loss rate of 4.5 dB per doubling of distance, background sound levels would be exceeded at distances of less than 3.1 miles (Table 3).

Potential for Biological Effects

Based on the foregoing analysis, the proposed action could result in underwater acoustic effects to marine mammals. The injury thresholds for pinnipeds and cetaceans would not be attained, but the acoustic background level in the area, 126 dB_{RMS}, would be attained during use of the vibratory pile driver (for wood piling removal and for CISS pile placement), and during augering of the CISS pile placements. Effect distances for these activities are shown in Table 3, and range up to 14.5 miles. The duration of exposure varies between activities.

Table 4. Noise generating activities.

Construction Activity	Number of piles	Time per pile	Duration of activity	No. of days when activity occurs	126 dB isopleth distance
18" pile vibratory installation	115	0:15	28:45	58	14.5 miles
Augering	115	1:00	115:00	58	1.5 miles
Wood Pile Removal	205	0:40	136:40	58	3.1 miles

Pile installation would occur for approximately 30 minutes on each of 58 days (Table 4), resulting in sound levels exceeding background within 14.5 miles of the activity.

Pile removal is a quieter activity performed for a longer time: approximately 136.67 hours distributed evenly over 58 days, or about 2.5 hours on each day when the activity occurs. Sound levels would exceed background within 3.1 miles of the activity.

Augering, the least-noisy activity, is estimated to require 1 hour for each of 115 piles with activity occurring on each of 58 days evenly distributed during a 180-day period, or about 2.0 hours on each day when the activity occurs. Sound levels would exceed background within 1.5 miles of the activity

These activities could be performed on the same day, but are expected to normally occur on consecutive days, with a cycle of pile removal - pile installation - augering - grouting occurring as each of 25 successive bents is placed.

As shown in Figures 1 and 2, Trinidad Bay is a protected from waves coming from the north and west, but open to coastline on the south. The coast extending to the south, and the rocky headland to the west of pier, would shield waters from the acoustic effects described above except within the bay itself. These topographic considerations result in a situation such that underwater noise-generating activities would produce elevated underwater sound within most of the bay itself, but would have a minor effect on underwater sound levels outside the bay.

Seals outside of Trinidad Harbor and more than 1-2 miles offshore are likely already exposed to and habituated to loud machinery noise in the form of deep-draft vessel traffic along the coast; such vessels may produce noise levels of the order of 170-180 dB_{RMS} at 10 meters and thus have areas of effect comparable to the 14.5-mile radius of effect calculated for vibratory pile driving noise. In this context, the 14.5-mile radius of effect is unrealistic, just as it is unrealistic to think that these seals alter their behavior in response to the passage of a large vessel 14.5 miles away. Behavioral considerations suggest that the seals would be able to determine that a noise source does not constitute a threat if it is more than a couple of miles away, and the sound levels involved are not high enough to result in injury (Level A harassment). Nonetheless, these data suggest that pile driving may affect seal behavior throughout Trinidad Harbor, i.e. within approximately one mile of the activity, on a line of sight to the activity. The nature of that effect is unpredictable, but logical responses on the part of the seals include tolerance (noise levels would not be loud enough to induce temporary threshold shift in harbor seals), or avoidance by using haul-outs or by foraging outside the harbor.

With regard to noises other than pile driving (pile removal, augering, and incidental construction noise), estimation of biological effects depends on the characteristics of the noise and the behavior of the seals. The noise is qualitatively similar to that produced by the engines of fishing vessels or the operations of winches, noises to which the seals are habituated and which they in fact regard as an acoustic indicator signaling good foraging opportunities near the pier. There are no data about the magnitude of this acoustic indicator, but the noise produced by the fishing vessel engines entering or leaving the harbor is likely not less than 150 dB_{RMS} at 10 meters, though it will be quieter as vessels throttle back near the pier. This level (150 dB_{RMS}) is the same as the estimated noise level from augering, and 15 dB less than the estimated noise level from pile removal. In this context, behavioral responses due to augering are not likely, except that initially seals might approach the work area in anticipation of foraging opportunities. Such behavior would cease once the seals learned the difference between the sound of the auger and that of a fishing vessel. Behavioral responses in the form of avoidance due to pile removal might occur within a distance of about 50 m from the activity, but the area so affected constitutes a small fraction of Trinidad Harbor and has no haul-outs; thus very few seals would be expected to be affected.

In-Air Noise

Noise Sources

The principal source of in-air noise would be the vibratory pile driver used to extract old wood piles and to place the new CISS piles. Laughlin (2010) has recently reported unweighted sound measurements from vibratory pile drivers used to place steel piles at two projects involving dock renovation for the Washington State

Ferries. In both projects, noise levels were measured in terms of the 5-minute average continuous sound level (L_{eq}). Frequency-domain spectra for the maximum sound level (L_{max}) were also measured. The Leq measurements in this case were equivalent to the unweighted RMS sound level, measured over a 5-minute period.

At the Wahkiakum County Ferry Terminal, one measurement station was used to take measurements of the vibratory placement (APE hammer) of one 18-inch steel in-water pile, the same size that would be placed during the Trinidad Pier renovation. At the Keystone Ferry Dock renovation, four measurement stations were used to take measurements of the vibratory placement (APE hammer) of one 30-inch steel in-water pile. At both sites, piles were placed in alluvial sediments, whereas the Trinidad Pier piles would be placed in pre-bored holes in sandstone.

Results for the Wahkiakum and Keystone piles are shown in Table 5.

Table 5. Noise measurements for vibratory pile placements reported by Laughlin (2010).

Location	Pile size	Distance to pile (ft)	Measured L_{eq} (RMS)	Measured L_{eq} standardized to 50 ft	Measured L_{max}	Measured L_{max} standardized to 50 ft
Wahkiakum	18"	39	88.6	87.5	94.9	93.8
Keystone*	30"	40	97.2	96.5	104.0	103.1
*Average of four replicate measurements						

Based on these data, in-air noise production during pile driving at the Trinidad Pier will likely be between 87.5 and 96.5 dB re: 20μPa, unweighted For the purposes of the analysis presented below, it is assumed that in-air noise from vibratory pile driving would produce 96 dB_{RMS}, unweighted. This noise would be produced during both pile removal and pile placement activities. The augering equipment produces slightly less noise: 92 dB_{RMS}, unweighted. All other power equipment that would be used as part of the proposed action (e.g., trucks, pumps, compressors) produces at least 10 dB less noise and thus has much less potential to affect wildlife in the area.

In contrast, background noise levels near the Trinidad Pier are already elevated due to normal pier activities. Marine mammals at Trinidad Bay haul-outs are presumably habituated to the daily coming and going of fishing and recreational vessels, and to existing activities at the pier such as operation of the hoists and the loading and unloading of commercial crab boats. These activities may occur at any time of the day and may produce noise levels up to approximately 82 dB (unweighted) at 50 feet for periods of up to several hours at a time. Accordingly 82 dB (unweighted) is chosen as the background level for noise near the pier.

Effects on Harbor Seals

In-air sound attenuates at the rate of approximately 5 dB/km for a frequency of 1 kHz, air temperature of 10°C, and relative humidity of 80% (Kaye & Laby 2010). These conditions approximate winter weather in Trinidad. Under these conditions, the noise of the vibratory pile driver would attenuate to approximately 82 dB at approximately 2.8 km (1.74 miles) from the pier. Attenuation, which is proportional to frequency, would be reduced at lower frequencies, and would be much greater at higher frequencies. Attenuation would also be greater at locations where headlands or sea stacks interfere with sound transmission, as shown in Figure 1. Accordingly, the sounds produced by pile extraction, augering, and pile placement would exceed background levels within almost all of Trinidad Harbor.

Few data are available on potential impacts of such acoustic disturbance on receptor species. Some information can be derived from existing guidance intended to protect nesting bald eagles and marbled murrelets from excessive noise levels. The current bald eagle guidelines (USFWS 2007) restrict loud noise-generating activity (the example given is aircraft operation, a sound considerably louder than vibratory pile driver operation) within 1,000 feet of active nests, while a disturbance threshold for nesting murrelets has been set at 70 dB (WSDOT 2006). Murrelets, however, nest in locations that normally have an extremely quiet background noise level.

Driving of CISS piles would occur for a total of approximately 0.5 hours per day on each of 58 days within a 180-day period (August 1 to January 31) (Table 4). Pile driving would occur during daylight hours, at which time harbor seals would be periodically coming to or leaving from haul-outs, and possibly foraging within the radius of effect around the pile driving activity.

Behavioral effects could result to all seals that were in the water within the area of effect during the portion of the day when piles were being driven (typically two piles per day). For instance, if seals spent 10% of the day in the water within the radius of effect, and assuming that the number of seals present that day was 36.6 (as discussed above in the context of data presented by Goley et al. [2007]), then about 3.66 seals would be affected by underwater noise from each of two pile drives. Because the drives occurred during different parts of the day, different seals would likely be affected, resulting in a total impact on that day to 7 or 8 seals.

The 10% estimate given above is a representative figure for the purposes of illustration. There are no data available on relative seal use of the haul-outs in Trinidad Bay, *versus* their use of waters in the Bay, *versus* their use of waters or haul-outs elsewhere. However, it is known that during winter months (when construction is proposed to occur), seal use of the haul-outs in Trinidad Bay likely declines because the seals spend a larger fraction of their time at sea, foraging in offshore waters (Goley 2007). Figure 1 shows that topographic shielding by headlands blocks a large area of offshore habitat from potential construction noise effects.

Impacts attributable to pile removal would be similar to those of pile driving, but pile removal would occur for a total of approximately 2.5 hours per day on each of 58 days (Table 4). Subject to the same assumptions as described above, but this time with the activity being performed on an average of 3.5 piles per day, about 3.66 seals would be affected by underwater noise from each of 3.5 pile removal events for a total daily impact to 13 seals.

Impacts attributable to augering would also be similar, but augering would occur for a total of approximately 2.0 hours per day on each of 58 days. Subject to the same assumptions as described above, but this time with the activity being performed on an average of 2 piles per day, about 7 or 8 seals would be affected by underwater noise from each of two augering events for a total daily impact to 7 or 8 seals.

Although harbor seals could be affected by in-air noise and activity associated with construction at the pier, seals at Trinidad Bay haul-outs are presumably habituated to human activity to some extent due to the daily coming and going of fishing and recreational vessels, and to existing activities at the pier such as operation of the hoists and the loading and unloading of commercial crab boats. These activities may occur at any time during the hours of daylight and may produce noise levels up to approximately 82 dB at 50 feet for periods of up to several hours at a time. The operation of loud equipment, including the vibratory pile driving rig and the auger, would be outside of the range of normal noise production at the pier and could potentially cause seals to leave a haul-out. However, there are no reported observations of seals leaving haul-outs in the bay in response to current levels of in-air noise and activity in the harbor. On the contrary, seals often approach the pier during normal fishing boat activities in anticipation of feeding opportunities associated with the unloading of fish and shellfish. This circumstance suggests seal habituation to existing noise levels encountered near the pier.

Based on these examples it appears likely that few seals at haul-outs would show a behavioral response to noise at the pier, particularly in view of their existing habituation to noisy activities at the pier. The great majority of haul-out locations in Trinidad Bay are at least 1,000 feet from the pier, but one minor haul-out is 230 feet from the pier (Dawn Goley pers. comm.. 2009.03.23). In view of the relatively large area that would be affected by elevated in-air noise, it appears probable that some seals could show a behavioral response, despite their habituation to current levels of human-generated noise; incidental take by this mechanism may amount to an average of one seal harassed per day, when the activities of pile removal, augering, or pile placement are occurring.

Effects on California Sea Lions

California sea lions, although abundant in northern California waters, have seldom been recorded at Trinidad Bay; i.e. there is little published information or data with which to determine how they use Trinidad Bay. Their low abundance in the area may be due to the presence of a large and active harbor seal population, which likely competes with the sea lions for foraging resource. Any sea lions that did visit the action area during construction activities would be subject to the same type of impacts described above for harbor seals. Observed use of the area by California sea lions amounts to less than 1% of the number of harbor seals (Dawn Goley pers. comm.. 2009.03.23); assuming a 1% utilization rate, total impacts to California sea lions would amount to 1% of the effects on harbor seals, described above.

Effects on Steller Sea Lions

Steller sea lions are extremely unlikely to be exposed to elevated underwater sound levels. Surveys performed between October through April have not documented any Steller sea lions at the Blank Rock haul-out (Figure 2), which is the closest haul-out to the action area and lies north of the area of potential effects. Very few animals have been seen at this haul-out in August or September (Sullivan 1980). Furthermore, when leaving haul-outs, sea lions generally travel seaward to forage in deeper waters where their prey is more abundant (National Marine Fisheries Service 2008). Steller sea lions have not been documented within Trinidad Bay over eight years of surveys conducted at the site (Dr. Dawn Goley, 2008, pers. comm.). Thus they are extremely unlikely to enter the area within which behavioral harassment might occur (Figure 1). Due to the shallow waters in the affected area and the large size of these animals, they would quickly be detected by the marine mammal monitor and work would be stopped until after the animals departed. Thus it is unlikely that they would be exposed to elevated underwater sound levels, and any exposure that did occur would be very brief.

Effects on Gray Whales

Goley et al. (2007) list the sighting rates for gray whales during 8 years of monthly observations at Trinidad Bay. Sighting rates varied from 0 to 1.38 whales per hour of observation time. The average detection rate during the period when pile removal and placement would occur, in the months from August through January, was 0.21 whales per hour of observation time. In contrast, the average detection rate in the months of February through July was 0.48 whales per hour. The majority of these detections were within 2 km of the shoreline (Goley et al. 2007). These data suggest that the effect rate for gray whales would be approximately 0.21 whales per hour. Since vibratory driving of CISS piles would occur for a total of approximately 28.75 hours (115 piles at 15 minutes drive time apiece; Table 4), vibratory pile driving activities would be expected to affect 0.21 × 28.75 = 6.04 or approximately six gray whales.

Acoustic effects would also be expected to result from pile removal, which is a quieter activity performed for a longer time. Approximately 205 piles will be removed, with 40 minutes of vibratory pile driver noise for each pile, resulting in a total exposure of 136.67 hours (Table 4). Thus this activity would be expected to affect 6.04 × 136.7 / 28.75 = 28.7 or approximately 29 gray whales.

Acoustic effects would also be expected to result from pile augering, which is an even quieter activity. There will be 115 holes augered, with 1 hour of noise for each hole, resulting in a total exposure of 115 hours (Table 4). Thus this activity would be expected to affect 6.04 × 115 / 28.75 = 28.7 or approximately 24 gray whales.

No mechanism other than underwater sound generation is expected to affect gray whales in the action area.

Effects on Killer Whales

Killer whales are rare visitors to Trinidad Bay, but there is currently a very high awareness of their potential presence due to an incident in May, 2008 when a transient killer whale was observed to take a seal on the beach at Trinidad Bay (Driscoll 2008). Any killer whales that did visit the action area during construction activities would be subject to the same type of potential impacts described above for gray whales.

Summary

Incidental harassment of harbor seals, California sea lions, and gray whales is anticipated to occur for the following reasons:

1. Surveys (described in Section 3 above) have demonstrated that harbor seals are almost always present within the area that would be affected by underwater sound. Thus it is not possible to avoid affecting harbor seals. Potential effects to harbor seals have been minimized by constructing during a period when sensitive life history stages (pupping and molting) do not occur and when seals spend a large portion of the day foraging in the ocean beyond Trinidad Bay, and by using construction methods that generate the lowest practicable levels of underwater sound.

2. California sea lions are found among the harbor seals, at about 1% of the harbor seal abundance; thus there is a substantial risk of incidentally affecting California sea lions at the same times and by the same mechanisms that harbor seals are affected.

3. Gray whales have a high likelihood of occurring in Trinidad Bay during the proposed construction period. They may not be detected by observers if they occur near the limits of the area of Level B (harassment) acoustic stress. Thus there is a substantial potential to affect gray whales.

4. The area has a high incidence of harbor fog, which complicates successful detection of animals when they enter waters where they may be exposed to sound levels in excess of the level B threshold. Dense fog is a common occurrence in this area in all seasons of the year. In 2008, for instance, the NOAA weather station in nearby Eureka reported 63 days of fog with visibility less than 0.25 mile, and 176 cloudy days. Local anecdotal reports indicate that the incidence of fog is much higher on the harbor waters than on the adjacent uplands. Attempting to only perform underwater sound generating activities during periods of high visibility is therefore impracticable, as it would greatly prolong the time required for construction. For this reason it is possible that marine mammals may enter waters where they may be exposed to sound levels in excess of the level B threshold without being detected by marine mammal observers. This is why the marine mammal monitoring plan (Appendix C) provides for work stoppage when visibility is less than 100 feet, and provides for auditory detection, and assumes that any auditory detection represents an animal that is within the area with sound levels in excess of the level B threshold.

Incidental take estimates are based on estimates of use of the bay by various species as reported by Goley (2007, cited in IHA application, supplemented by pers. comm. with her in 2009). All activities generating underwater sound exceed background sound levels throughout the Bay. Activities generating in-air noise attenuate to 82 dBA at distances of up to 1.74 miles, and thus also may be perceived throughout the Bay. Table 6 summarizes noise production and anticipated incidental take via behavioral modification, for each of these mechanisms. In no case will sound be produced that is loud enough to result in incidental take via physical injury.

Table 6. Enumeration of Anticipated Incidental Take.

Variable	**Activity* Wood pile removal**		**Augering**		**Vibratory pile installation**	
	Underwater noise	In-air noise	Underwater noise	In-air noise	Underwater noise	In-air noise
Sound amplitude	156.5 dB_{RMS} at 33 feet	96 dBA at 50 feet	150 dB_{RMS} at 33 feet	92 dB at 50 feet	175 dB_{RMS} at 33 feet	96 dBA at 50 feet
Sound duration per day (hours)	2.5		2		0.5	

Variable	Activity* Wood pile removal		Augering		Vibratory pile installation	
Activity frequency per day	2		3.5		2	
Number of days*	58		58		58	
Total hours exposure	145		116		29	
Incidental take of harbor seals per day	13 seals exposed	1 seal exposed	7 or 8 seals exposed	1 seal exposed	7 or 8 seals exposed	1 seal exposed
Incidental take of harbor seals, total	754 exposures	58 exposures	435 exposures	58 exposures	435 exposures	58 exposures
Incidental take of California sea lions, total	7.5 exposures	0.6 exposure	4.4 exposures	0.6 exposure	4.4 exposures	0.6 exposure
Incidental take of Steller sea lions	None	None	None	None	None	None
Incidental take of gray whales, total	28.7 exposures	None	28.7 exposures	None	6.04 exposures	None
Notes * No two activities would be performed on any given day.						

6. Age, sex, reproductive condition, and number of marine mammals that may be taken by each type of taking, and the number of times such takings by each type of taking are likely to occur

Harbor seal: As detailed in Sections 3 and 5, harbor seal presence in the activity area is perennial, with daily presence of an average of 36.5 seals at a nearby haul-out during the months when the activity would occur. The fraction of these seals that would be in the activity area is difficult to estimate. Traditionally the seals have regarded the pier as a prime foraging area due to the recreational fishing activity and the unloading of fishing boats that occur there. During the construction period, however, these activities would cease, and it is plausible that the seals would modify their foraging behavior accordingly. Based on the analysis presented in Section 5, 7 or 8 seals would be affected per day on each of 116 days when pile driving or augering occurred, 13 seals would be affected per day on each of 58 days when pile removal occurred, and one seal would be affected by in-air noise on each of 174 days when pile removal, installation, or augering occurred. The potentially affected seals include adults of both sexes. The winter population of seals in Trinidad Bay seems to consist mostly of resident seals (Goley et al. 2007), so it is likely that most seals in the population would be affected more than once over the course of the construction period. It is therefore possible that some measure of adaptation or habituation would occur on the part of the seals, whereby they would tolerate elevated noise levels and/or utilize haul-outs relatively distant from construction activities. There are a large but uninventoried number of haul-outs within Trinidad Bay, so such a strategy is possible, but it is difficult to predict whether the seals would show such a response.

California sea lion: As detailed in Section 5, there is a small possibility of behavioral effects related to project acoustic impacts, in the event of California sea lion presence in the activity area. Based on an interview with Dawn Goley (pers. comm. 2009.03.23), California sea lions have been seen in the activity area, albeit infrequently, and there are no quantitative estimates of the frequency of their occurrence. Assuming that they are present with 1% of the frequency of harbor seals, it is possible California sea lions might be subject to behavioral harassment at up to 1% of the levels described above for harbor seals. The potentially affected sea lions include adults of both sexes.

Gray whale: As detailed in Section 5, the most likely number of gray whales that would be taken is 59. Based on the low detection rate of 0.21 whales per hour (Goley et al. 2007), most of these take events would likely be independent. Based on past observations of gray whales in the harbor (Goley et al. 2007), whales would likely be adults of both sexes.

Section 5 above shows that at no time would the level A effect thresholds for pinnipeds/cetaceans of 180/190 dB RMS be exceeded.

Project scheduling avoids sensitive life history phases of harbor seals. Project activities producing underwater noise would commence in August. This is after the end of the annual molt, which normally occurs in June and July. Project activities producing underwater noise are scheduled to terminate at the end of January, which is a full month before female seals commence to seek sites suitable for pupping.

7. The anticipated impact of the activity upon the species or stock

As shown in Section 6 above, the activity has negligible potential to affect stocks of any marine mammals. The activity would result in no injury, death, or alteration or reproductive behaviors, and the potentially affected species (gray whale, California sea lion and harbor seal) would be subject only to temporary and minor behavioral impacts.

8. The anticipated impact of the activity on the availability of the species or stocks of marine mammals for subsistence uses

Not applicable.

9. The anticipated impact of the activity upon the habitat of the marine mammal populations, and the likelihood of restoration of the affected habitat

The anticipated adverse impacts upon habitat consist of temporary changes to water quality and the acoustic environment, as detailed in Sections 3 and 5. These changes are minor, temporary, and limited in duration to the period of construction. No restoration is needed because the project would have a net beneficial effect on habitat in the activity area by removing an existing source of stormwater discharge and creosote-treated wood.

The proposed project could have a slight and temporary effect on seal and sea lion use of haul-outs. This could occur because the pier functions as a habitat feature; seals and sea lions often appear there when fishing boats dock, to take advantage of foraging opportunities that may arise as cargo is offloaded. Since this activity would cease to occur at the pier, seals and sea lions would be less likely to use the area. The fishing vessels that normally use the pier during the months when construction would occur, have two options. They can either transfer their cargoes to smaller vessels capable of landing at the existing boat ramp (which is on the east side of the rocky headland just east of the pier, a few hundred feet away), or they can make temporary use of pier facilities approximately 20 miles to the south, in Eureka. Vessels using cargo transfer would likely provide an alternative foraging option for the seals. Vessels traveling to Eureka would likely represent a lost foraging opportunity for seals using Trinidad Bay.

10. The anticipated impact of the loss or modification of the habitat on the marine mammal populations involved

The temporary impacts on water quality and acoustic environment and the beneficial long-term effects, described in Section 9 above, are not expected to have any effects on the populations of marine mammals occurring in Trinidad Bay. The area of habitat affected is small and the effects are temporary, thus there is no reason to expect any reduction in habitat available for foraging and other habitat uses.

11. The availability and feasibility (economic and technological) of equipment, methods, and manner of conducting such activity or other means of effecting the least practicable adverse impact upon the affected species or stocks, their habitat, and on their availability for subsistence uses, paying particular attention to rookeries, mating grounds, and areas of similar significance

The proposed activity is detailed in Section 3 and includes a variety of measures calculated to minimize potential impacts on marine mammals, including:

- timing the activity to occur during seasonal lows in marine mammal use of the activity area;
- limiting activity to the hours of daylight (7 AM to 7 PM, with noise generating activities only authorized from one-half hour after sunrise until one-half hour before sunset);
- use of a vibratory hammer to minimize the noise of piling removal and installation;
- use of trained monitors to detect, document and minimize impacts to marine mammals, as detailed in the Marine Mammal Monitoring Plan (Appendix C);
- use of varied measures, described in Section 3 above, to minimize potential impacts to water quality;

- removal of existing creosoted and other treated wood at the project site, and avoidance of such materials in the renovated structure;
- lighting design to minimize illumination of the water surface;
- structural design to minimize shading of the water surface; and
- full treatment and infiltration of all stormwater falling on the completed structure.

12. Where the proposed activity would take place in or near a traditional Arctic subsistence hunting area and/or may affect the availability of a species or stock of marine mammal for Arctic subsistence uses …

The proposed activity would not take place in or near a traditional Arctic subsistence hunting area, and would not affect the availability of any species or stock of marine mammal for Arctic subsistence uses.

13. The suggested means of accomplishing the necessary monitoring and reporting that will result in increased knowledge of the species, the level of taking or impacts on populations of marine mammals that are expected to be present while conducting activities and suggested means of minimizing burdens by coordinating such reporting requirements with other schemes already applicable to persons conducting such activity

Marine mammal monitoring and reporting shall be performed consistent with procedures to be directed by NMFS in the terms of the incidental harassment authorization. Such conditions have not yet been placed but are provisionally anticipated to include the terms described in the Marine Mammal Monitoring Plan (Appendix C). Principal elements of that plan are reproduced here:

1. An approved marine mammal observer shall attend the project site one hour prior until one hour after construction activities cease each day throughout the construction window.

2. The observer shall be approved by NMFS.
3. The observer shall search for marine mammals within behavioral harassment threshold areas as identified in Table 1 and Figure 1 [of the Plan]. The area observed shall depend upon the type of underwater sound being produced: pile extraction, augering, or pile installation.
4. The observer shall be present on the pier during pile driving, augering, and pile extraction to observe for the presence of marine mammals in the vicinity of the activity. All such activity will occur between one-half hour after sunrise and one-half hour before sunset. If inclement weather limits visibility within the area of effect, the observer will perform visual scans to the extent conditions allow, but activity will be stopped at any time that the observer cannot clearly see the water surface out to a distance of at least 100 feet from the activity. In conditions of good visibility, observers will likely be able to detect pinnipeds out to a range of approximately 0.5 miles from the pier, and to detect whales out to a range of approximately 1.0 miles from the pier. Animals at greater distances likely would not be detected.
5. The observer will also perform , and will also report any auditory evidence of marine mammal activity. Auditory detection will be based only on the use of the human ear. Auditory monitoring is highly effective for detecting gray whales. Auditory monitoring prior to the start of the noise-generating activity occurs in the absence of masking noise and thus helps to ensure that the auditory monitoring is effective. Note that there will also be many quiet periods between individual noisy activities, during which whales can be detected. Most of the work day is spent in preparing for a few noisy intervals. Auditory monitoring is less effective for pinnipeds.
6. The observer will scan the area for at least 30 minutes continuously prior to any episode of in-water work to determine whether marine mammals are present, and will continue to scan the area during the period of in-water work. The scan will continue for at least 30 minutes after each in-water work episode has ceased. The scan will involve two visual "sweeps" of the area using the naked eye and binoculars. Typically, the sweep would be conducted slowly as follows: one sweep going from left to right and the other returning from right to left. The length of time it takes to do the sweep will depend on the amount of area that needs to be covered, weather conditions, and the time it takes the monitor to thoroughly survey the area.
7. Pile driving will not be curtailed if the only marine mammals detected within the area of effect are harbor seals. If any other marine mammals besides harbor seals are observed within the area of effect, pile driving will not commence. If a marine mammal swims into the area of effect during pile driving, the observer will identify the mammal and, if it is not a harbor seal, will notify the Project Engineer who will notify the Contractor, and pile driving will stop. If the animal has been observed to leave the area of effect, or 15 minutes have passed since the last observation of the animal, pile driving will proceed.
8. If a marine mammal is sighted by the observer, the observer shall record the following information: date and time of initial sighting, tidal stage, weather conditions, sea state, species, behavior (activity, group cohesiveness, direction and speed of travel, etc.), number, group composition, distance to

sound source, number of animals impacted, construction activities occurring at time of sighting, and monitoring and mitigation measures implemented (or not implemented). These observations will be reported to NMFS in a letter report to be submitted on each Monday, describing the previous week's observations.

9. A final report will be submitted summarizing all in-water construction activities and marine mammal monitoring during the time of the authorization, and any long term impacts from the project.

14. Suggested means of learning of, encouraging, and coordinating research opportunities, plans, and activities relating to reducing such incidental taking and evaluating its effects

The impacts of the proposed activity have been reduced, as described in Section 12 above, to the greatest practicable extent. Further reductions could only be achieved by making the activity quieter or by performing it more quickly, both of which represent technical challenges far beyond the scope of this project.

Existing knowledge gaps regarding the Trinidad Bay harbor seals were identified in discussions with Dr. Dawn Goley, professor, Humboldt State University. Dr. Goley noted that the timing and movements of the Trinidad Bay harbor seals are not well understood, and could be advanced by radio tracking studies of a representative group of seals. Dr. Goley also noted the uncertain relationship between Trinidad Bay and Patrick's Point seals, and noted that the radio tracking study might help to elucidate that relationship.

15. Literature Cited

Baechler, J., C.A. Beck, and W.D. Bowen. 2002. Dive shapes reveal temporal changes in the foraging behaviour of different age and sex classes of harbour seals (Phoca vitulina). *Canadian Journal of Zoology* 80: 1569-1577.

Coltman, D.W, Bowen, W.D., Bonessi, D.J. and S.J. Iverson. 1997. Balancing foraging and reproduction in the male harbour seal, an aquatically mating pinniped. *Animal Behavior* 54: 663-678.

Cummings, J. 1987.12. An Investigation of the Cyclic Nature of the Ambient Noise within Lake Pend Oreille. Final rept. Jan-Dec 86. DTIC Accession No. ADA189296.

Driscoll, J. 2008.05.26. Tiger of the sea. *Eureka Times-Standard*. Eureka, California.

Federal Highway Administration. 2006. FHWA Roadway Construction Noise Model User's Guide. http://www.fhwa.dot.gov/environment/noise/rcnm/index.htm, accessed February 20, 2009.

Goley, D., A. Ougzin and C. Hudson. 2007. Gray Whale and Harbour Seal Distribution and Abundance in Northern California: A report to supplement the Trinidad Pier Reconstruction Project. Arcata: Humboldt State University. June.

Guedel, G.A. 1992. Acoustic test facilities at Lake Pend Oreille in Idaho. *Journal of the Acoustical Society of America* 92(4):2399.

Illingworth & Rodkin. 2007. Compendium of Pile Driving Sound Data. Prepared for The California Department of Transportation, Sacramento, CA. Available: http://www.dot.ca.gov/hq/env/bio/files/pile_driving_snd_comp9_27_07.pdf, accessed February 8, 2010.

Illingworth & Rodkin, Inc. 2008. Draft Analysis of Underwater Sound Levels – Trinidad Pier Reconstruction Project, Trinidad Bay in Humboldt County. Prepared for Jacque Hostler, Roads Director for the Trinidad Rancheria, Cher-Ae Heights Indian Community of the Trinidad Rancheria, Trinidad, CA.

Kaye and Laby. 2010. Tables of Physical & Chemical Constants, section 2.4.1: The speed and attenuation of sound. <http://www.kayelaby.npl.co.uk/general_physics/2_4/2_4_1.html>. Accessed July 21, 2010.

Laughlin, Jim. 2010. Airborne noise measurements (A-weighted and un-weighted) during vibratory pile installation - technical memorandum. Washington State Department of Transportation. June 21, 2010.

National Marine Fisheries Service. 2006. Draft Revised Recovery Plan for the Steller sea lion (*Eumetopias jubatus*). National Marine Fisheries Service, Silver Spring, Maryland, USA. 285 pp.

National Marine Fisheries Service. 2008. Recovery Plan for the Steller Sea Lion (*Eumetopias jubatus*). Revision. National Marine Fisheries Service, Silver Spring, MD. 325 pp.

National Research Council. 2003. *Ocean Noise and Marine Mammals*. National Academy Press, Washington, D.C.

Richardson, W.J., C.R. Greene Jr., C.I. Malme, and D.H. Thomson. 1995. *Marine Mammals and Noise*. New York: Academic Press. 576pp.

Sullivan, R. 1980. Seasonal occurrence and haul-out use of pinnipeds along Humboldt County, California. *Journal of Mammalogy* 61: 754 – 760.

Taber Consultants. 2007. Foundation Investigation, Trinidad Pier Replacement, Trinidad, California. Prepared for Cher-Ae Heights Indian Community, Project Owner.

Thompson, P.M., D. Miller, R. Cooper and P.S. Hammond. 1994. Changes in the distribution and activity of female harbour seals during the breeding season: implications for their lactation strategy and mating patterns. *Journal of Animal Ecology* 63(1): 24-30.

U.S. Fish and Wildlife Service. 2007. National Bald Eagle Management Guidelines. http://www.fws.gov/pacific/eagle/NationalBaldEagleManagementGuidelines.pdf, accessed February 8, 2010.

Van Parijs, S.M., Thompson, P.M., Tollit, D.J. and A. MacKay. 1997. Distribution and activity of male harbour seals during the mating season. *Animal Behavior* 54: 35-43.

Washington State Department of Transportation. 2006. Biological Assessment Manual, Part 2: Guidance on Specific Biological Assessment Topics. Chapter 7, Noise Impact Assessment. Olympia, WA: Washington State Department of Transportation.