MARINE AND NOISE MONITORING PLAN
FOR THE
34TH AMERICA'S CUP/ CRUISE TERMINAL PROJECT

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1.0 INTRODUCTION

The 34th America's Cup (AC34)/James R. Herman Cruise Terminal (cruise terminal) project consists of hosting 34th America's Cup race events in San Francisco Bay, constructing improvements along the San Francisco waterfront to establish necessary support facilities for race events and construction for the cruise terminal at Piers 27-29 in San Francisco.

The project sponsors (the America's Cup Event Authority (ACEA) and the Port of San Francisco (Port) either have obtained or are in the process of obtaining several natural resource permits to authorize the construction of proposed temporary and permanent improvements along with the AC34 race events. Some of these permits trigger monitoring requirements to protect marine biological resources. Specifically, the project sponsors have applied for the following permits which in addition to the Environmental Impact Report (EIR) prepared for this project under the California Environmental Quality Act (CEQA), include marine monitoring requirements:

- Section 10 permit from the U.S. Army Corps of Engineers (USACE) under the Rivers and Harbors Act to place temporary structures within San Francisco Bay;
- Marine Event Permit from the U.S. Coast Guard (USCG) to hold the AC34 race events;
- Biological Opinion from the National Marine Fisheries Service (NMFS) under the Federal Endangered Species Act (ESA), which includes review of Essential Fish Habitat under Section 305(b) of the Magnuson-Stevens Fishery Conservation and Management Act;
- Incidental Harassment Authorization (IHA) from NMFS pursuant to Section 101(a)(5)(D) of the Marine Mammal Protection Act (MMPA) of 1972; and
- Take assessment for review by California Department of Fish and Game (CDFG) pursuant to the California Endangered Species Act.

Project activities that require monitoring to ensure the protection of biological resources include pile driving (both vibratory and impact), boat race events, helicopter operations and fireworks displays. Accordingly, monitoring will need to be conducted both during construction and race event activities, as applicable.

Monitoring will not be conducted during pile, floating dock and mooring removal activities.

This plan consolidates applicable regulatory requirements associated with marine biological and noise monitoring and details the monitoring proposed for each applicable project component.

1.1 Regulatory Requirements

Marine Mammal Regulations

The MMPA prohibits the intentional harassment of marine mammals. NMFS defines harassment as "any act of pursuit, torment, or annoyance which has the potential to injure a marine mammal or marine mammal stock in the wild (Level A harassment) or has the potential to disturb a marine mammal or marine mammal stock in the wild by causing disruption to behavioral patterns, including, but not limited to, migration, breathing, nursing, breeding, feeding, or sheltering (Level B harassment).NMFS currently believes that underwater sound pressure levels (SPLs) above 190 decibels (dB) root mean square (rms) could cause injury (Level A harassment) in pinnipeds and SPLs above 180 dB rms could cause injury (Level A harassment) in cetaceans.. Federal Register Notice (Vol. 70 pp. 1871-1875) established thresholds for behavioral harassment of marine mammals (Level B harassment) at 160 dB rms for pulsed sounds, such as are produced by impact pile driving, and at 120 dB rms for continuous sounds, such as are produced by vibratory pile driving. Table 1-1 provides the sound thresholds and estimated distances related to marine mammal injury and disturbances from vibratory and impact pile driving as per the Incidental Harassment Authorization (IHA) for this project.

To comply with the MMPA, the ACEA and Port have submitted an IHA application to authorize the potential Level B harassment to the following four marine mammal species in San Francisco Bay; harbor seal (*Phoca vitulina richardii*), California sea lion (*Zalophus californius*), harbor porpoise (*Phocoena phocoena*), and elephant seal (*Mirounga angustirostris*) associated with the project. The IHA application included a measure to prepare a marine mammal monitoring plan. This plan is being created in part to comply with this proposed measure.

Endangered Species Act and Essential Fish Habitat Regulations

As referenced above, the project sponsors have prepared a biological assessment (BA) to complete formal consultation with the NMFS under Section 7 of the Endangered Species Act (ESA), and to address Essential Fish Habitat (EFH) under the Magnuson-Stevens Fishery Conservation and Management Act (MCMA), for the AC34 and Cruise Terminal projects. The BA addressed potential impacts to federally listed fish species and EFH from pile driving.

Table 1-1 Estimated distances to marine mammal sound thresholds during pile driving

Threshold	Distance (meters/feet)
IMPACT PILE DRIVING	
Pinniped Injury 190dB	n/a
Cetacean Injury 180 dB	2.2 m / 7 ft
Disturbance 160 dB	46 m / 151 ft
Airborne Disturbance 100 dB	5.3 m / 17 ft
Airborne Disturbance 90 dB	17 m / 56 ft
VIBRATORY PILE DRIVING	
Pinniped Injury 190 dB	n/a
Cetacean Injury 180 dB	n/a
Disturbance 133 dB [a]	926 m / 3038 ft
Airborne Disturbance 100 dB	6.8 m / 22 ft
Airborne Disturbance 90 dB	22 m / 72 ft

Note:
a - 133 dB is an interim proxy for ambient sound, not the threshold (i.e., 120 dB)

In addition, an informal biological assessment (take assessment) was produced to address state listed species under the California ESA, which was reviewed and approved by CDFG. CDFG agreed that with the implementation of proposed conservation measures, which included monitoring for listed fish species, the project would not result in state level take of state listed fish species.

The Fisheries Hydroacoustic Working Group (FHWG), whose members include NMFS' Southwest and Northwest, California, Washington, and Oregon departments of transportation, CDFG, and the U.S. Federal Highway Administration, issued an agreement to establish interim threshold criteria to determine the effects of high-intensity sound on fish. While these criteria are not formal regulatory standards, they are generally accepted as viable criteria for underwater noise effects on fish. These criteria were established after extensive review of the most recent analysis of the effect of underwater noise on fish. The agreed-upon threshold criteria for impulse-type noise to harm fish have been set at 206 dB peak, 187 dB accumulated SPL for fish over 2 grams, and 183 dB for fish less than 2 grams

(CalTrans, 2009). The conservation measures identified in the Section 7 BO with NMFS will be enforced through the Section 10 USACE Permit and the MEP issued by the USCG

The purpose of this Monitoring Plan is to establish protocols to ensure compliance with permit requirements. Based on the regulations and permits cited above, the following provides a general overview of the standards and requirements that project sponsors must follow during pile driving, helicopter operations, and fireworks displays to avoid and reduce impacts to marine mammals and sensitive fish species:

1) Monitoring during pile driving activities:
    a) Vibratory Pile Driving:
        i) There are no restrictions on concurrent vibratory pile driving (i.e., multiple locations and/or multiple rigs)
        ii) See Table 1-1 for relevant acoustic thresholds and estimated distances to thresholds. Note that for Level B harassment associated with vibratory pile driving, estimated distance is for sound attenuation to the level of ambient sound (133 dB) rather than to threshold (120 dB).
        iii) FHWG established sound thresholds of 183 dB for potential impact to fish < 2 grams and 187 dB for fish > 2 grams.
        iv) Noise monitoring during vibratory pile driving will include baseline measurements of ambient noise for up to three consecutive days before pile driving at each location and noise monitoring during the first two days (out of a maximum of seven) of vibratory pile driving in each location to confirm/establish zones of influence related to the sound thresholds.
        v) Visual monitoring of all marine mammals observed within proximity and within zones of influence during pile driving activities.
    b) Impact Pile Driving:
        i) Impact pile driving will not occur concurrently with any other impact pile driving activities.
        ii) Federal Register Notice (Vol. 70 pp. 1871-1875) established thresholds for behavioral harassment of marine mammals (Level B harassment) at 160 dB rms for pulsed sounds, such as are produced by impact pile driving. NMFS currently believes that underwater sound pressure levels (SPLs) above 190 decibels (dB) root mean square (rms) could cause injury (Level A harassment) in pinnipeds and SPLs above 180 dB rms could cause injury (Level A harassment) in cetaceans. Table 1-1 provides the sound thresholds and estimated distances related to marine mammal injury and disturbances from impact pile driving.
        iii) FHWG established sound threshold of 183 dB for potential impact to fish < 2 grams and 187 dB for fish > 2 grams.
        iv) Noise monitoring for impact pile driving will include a baseline survey of ambient noise for three consecutive days at Pier 19 prior to pile driving and measurements during the first five days (of impact pile driving to ensure a sufficient number of piles have been monitored to confirm/establish zones of influence related to the sound thresholds.
        v) Visual monitoring of all marine mammals observed in proximity and within zones of influence during pile driving activities.

2) Monitoring during helicopter operations.

    Race events will be held in August and October in 2012 and July – September in 2013. During race events approximately three helicopters will perform coverage of the races. It is anticipated

that a total of approximately 52 days of racing will be covered by helicopter operations during both the World Series events in 2012 and AC34 events in 2013. As detailed in Section 3, Pier 39 will be monitored for disturbances to California sea lion from the presence of helicopters.

The helicopters following each race will fly between 100 and 400 feet above sea level (asl) within the race area. The helicopters will normally perform coverage operations for up to three hours on a tank of fuel and will require refueling once per day. The helicopters will refuel at a secure airport or helipad and be secured there overnight between race days. All helicopter fueling and overnight landing and storage will occur at one or more existing regional airports or approved helipads. The coordination of the helicopters during race events will be such that one or two will stay above 400 feet asl and other helicopters will fly between 100-400 feet asl to more closely cover the racing action. The helicopters will be choreographed and move around the racecourse to anticipate the next important stage of each race for filming.

To protect avian sensitive species, the project sponsors will restrict helicopter operations such that they would avoid the air space within at least 1,000 feet (vertically and horizontally) around Alcatraz Island. This air space restriction distance of at least 1,000 feet (vertically and horizontally) will also be applied for race-related helicopter flight patterns above Crissy Beach Wildlife Protection Area. During flight operations, helicopters will minimize impacts to pinnipeds by avoiding low flying (< 100ft asl) over pinniped haul out areas at Pier 39.

An existing helipad on the southeastern corner of Treasure Island is proposed to serve as a temporary staging location for these helicopters, such as between individual races on a race day. Final details of helicopter operations will be provided in the Water and Air Traffic Plan that will be developed and implemented for AC34.

3) Monitoring during fireworks displays.
Approximately four fireworks displays are planned for AC34 race events (two – 30 minute displays and two -45 minute displays) during 2013. Pre and Post event surveys will be conducted within the acute fireworks impact area. Section 6provides greater detail on the monitoring procedures associated with fireworks.

4) Monitoring during race events.
As proposed by the project sponsors, the Course Marshal would establish a race course for each racing day within the conditions and parameters established under the USCG's Special Local Regulations (SLR), final CEQA and NEPA documents, and various regulatory approvals and permits. Attendants will be at the starting line and each turning mark, umpires (two) and several support boats will be out on the course. All race management personnel are tasked with scanning for debris or other obstructions that could possibly damage or impede fair play. Although unlikely, in the event that a large marine mammal, such as a whale is observed, the Course Marshal would notify all the other course marshals and officials via radio and postpone or abandon the race depending on the direction the whale is moving or its presence within or near the race course. These actions would be taken to ensure the safety of the marine mammals as well as the racing boats and crews. Obstructions and debris would also be managed or removed by race management personnel.

1.2 Program Objectives

The objectives of this program are to:

- Measure sound pressure levels from vibratory and impact pile driving to establish zones of influence related to sound thresholds for fish and marine mammals.
- Avoid injury to marine mammals through visual monitoring of identified zones of influence and cease pile driving activities if any animals enter the shutdown zone (e.g., impact pile driving area).

- Establish parameters to monitor site locations for the disturbance of marine mammals during pile driving activities, helicopter operations, and firework displays.
- Conduct field operations to obtain data as follows:
  1) Using sound meters, measure baseline of ambient noise in the vicinity of pile driving locations.
  2) Measure noise from vibratory and impact pile driving to establish/confirm threshold distances in Table 1-1.
  3) Make daily observations and record presence or absence of fish and marine mammals.

These objectives will be accomplished in accordance with the IHA, NMFS Biological Opinion, and pertinent permit conditions for the AC34 Project.

2.0 PILE INSTALLATION MONITORING

Piles will be driven using a vibratory hammer to install floating docks at the following locations: Pier 80, 30-32, 14 North, 9, 23 North and South, 27, 29 and offshore of Marina Green (See Figure 1 at end of document). Wood piles will be installed using an impact hammer at Pier 19 to improve and support the improvements made to the apron. Table 2-1 provides the proposed maximum number of piles to be driven at each location, production rate and projected construction time.

Table 2-1 Pile driving locations and number of piles for AC34 Project

Location	Number of Piles	Installation	Anticipated production rate (piles/day)	Anticipated Construction Timeframe
Vibratory Hammer Installation of Steel Piles (18 inch)				
Pier 80	26	Vibratory	8	August 2012
Pier 32 South	27	Vibratory	8	August 2012
Pier 14 North	44	Vibratory	8	June 2013
Pier 9	15	Vibratory	8	June 2013
Pier 23 North	21	Vibratory	8	May – June 2013
Pier 23 South	16	Vibratory	8	May – June 2013
Pier 27	55	Vibratory	8	May – June 2013
Pier 29 East	5	Vibratory	8	May – June 2013
Pier 29	21	Vibratory	8	November 2012
Marina Green Offshore	14	Vibratory	8	August 2012
Impact Hammer Installation of Wood Piles (12 inch)				
Pier 19	224	Impact	8	August 2012 – December 2012

2.1 Construction Methods

A vibratory hammer APE Model 100 or similar will be used to install 18 inch steel piles for floating docks. An impact hammer DELMAG D25-32 to D30-32 or similar type will be used to install the 12 inch wood piles for apron repairs at Pier 19. Depending on the location and logistics, piles will be installed from the existing deck structure using land based pile driving equipment or from a marine derrick barge. All construction equipment for pile driving will comply with all applicable equipment sound standards. If any equipment has been modified from its original factory installation the equipment utilized will have sound control devices no less effective than those provided on the original factory installation.

A "ramp up" process will be implemented for all pile driving activities. A ramp-up process includes various types of slow-start pile driving techniques to alert any animals close to the activity and allow them time to move away from impending construction. This process is intended to reduce exposure of animals to elevated sounds. The following ramp-up and sound minimizing procedures will be used for in-water pile installation:

a) A ramp-up technique (see b and c below) will be used at the beginning of each day's pile driving activities or when pile driving has ceased for more than 30 minutes.

b) During vibratory pile driving, contractors will initiate sound from vibratory hammers for 15 to 30 seconds at reduced energy followed by a 30 second waiting period. This procedure will be repeated two additional times before full energy may be achieved for each pile driven.

c) For impact pile driving at Pier 19, contractors will conduct soft starts followed by a 30 second waiting period then two subsequent sets.

d) Only one impact pile driver may be operated at a time for any AC34 construction activities at Pier 19. Impact pile driving may only occur in daylight hours.

e) When using an impact hammer, a cushion block or similar device will be used for sound attenuation at all times.

2.2 Measurement of Sound Pressure Levels

Sound monitoring data are needed to determine source sound pressure levels within construction areas and to verify estimated distances to the sound thresholds identified above in Section 1.

2.2.1 Ambient Sound Monitoring

Monitoring in the absence of construction activities will be conducted continuously for three consecutive days to determine ambient underwater noise levels in representative locations for impact and vibratory pile driving, such as Pier 32 South, Pier 19, and Pier 23 during hours that pile driving will occur (6am – 6pm). The meters will be placed at two depths: approximately mid water column and at a depth near the bottom of the water column but at least 1 m (3 ft) above the bottom. Data will be used to calculate an average Root Mean Square (RMS) value representative of the ambient conditions in the proposed pile driving locations in the absence of AC34 related construction activities.

2.2.2 Sound Monitoring During Vibratory Pile Driving

Monitoring for Sound Impacts to Marine Mammals

As shown in Table 1-1, estimated distances to various sound thresholds will be used to establish zones of influence (ZOIs) for marine mammals. NMFS currently recommends a preliminary 926-m (3,038 ft) radius zone of influence (ZOI) around a vibratory pile-driving site for marine mammals (77 Fed Reg No. 106 pg. 32573 - 32578 Friday June 1, 2012). The disturbance zone is intended to include all areas where the underwater noise levels are anticipated to exceed ambient sound levels and/or the 120dB threshold. Once pile driving begins, SPLs will be recorded at the 926-m (3,038-ft) contour. The safety zone radius for

marine mammals will then be enlarged or reduced, depending on the actual recorded sound levels. On the first two days of vibratory pile driving (during an anticipated maximum of seven days) of pile driving at each location; field staff will measure SPLs at four distances from the pile being driven at 10 meters, 100 meters, 500 meters and 926 meters. Real time data from these measurements will be evaluated within 72 hours and mean values established and translated to the field personnel via phone for field interpretation and clarification of the boundaries of the disturbance zones. Noise levels will be measured during the entire driving session at these distances for each pile driven the first two days at the first floating dock installation location. It is assumed that the same vibratory pile driving technique will be used in the same substrate at the other floating dock installation locations, therefore a similar ZOI can be used at these other locations.

Measurements will be conducted at two depths: approximately mid water column and a depth near the bottom of the water column but at least 1 m (3 ft) above the bottom

Once the disturbance zone has been established during the first two days of vibratory pile driving, the remainder of pile driving will utilize this established distance for visual monitoring. Additional sound monitoring will not be conducted for marine mammal monitoring, only visual observations as detailed in Section 2.2.4 will be conducted on a daily basis during any vibratory pile driving based on the established ZOI. It is assumed that the same vibratory pile driving technique will be used at the other floating dock installation locations, accordingly the same distance established for the ZOI in one location will be utilized to visually monitor at the other pile driving locations.

Monitoring for Sound Impacts to Fish

Monitoring will include underwater sound measurements within and at the threshold boundary at which lethal sound impacts are anticipated. As stated above, the FHWG established sound threshold of 183 dB for potential impact to fish < 2 grams and 187 dB for fish > 2 grams. The disturbance thresholds are lower for marine mammals than threshold levels for impacts to fish. Accordingly, the sound monitoring the ZOIs for marine mammal monitoring will subsume or contain the calculated injury zones related to fish. Sound measurements taken the first two days will verify whether SPLs are below impact thresholds for fish. Accordingly, additional fish specific sound monitoring is not proposed since the marine mammal thresholds are lower and more protective.

If any dead or moribund fish are observed during pile driving, they will be collected and identified. NMFS and CDFG will be notified immediately and pile driving operations will be halted for the remainder of the day. Sound monitoring measurements will be initiated the following day when pile driving is initiated within and at the threshold boundary of where lethal sound impacts are anticipated.

2.2.3 Sound Monitoring During Impact Hammer Pile Driving

Monitoring for Sound Impacts to Marine Mammals

Preliminary zones of influence (ZOI) shall be established around the pile-driving site (Federal Register /Vol. 77, No. 106 Friday June 1, 2012) during impact hammer pile driving as shown in Table 1-1. These ZOIs are intended to include all areas where the SPLs are anticipated to exceed 180 dB RMS (2.2 meters/7 feet) for injury to cetaceans and 160 dB RMS (46 meters/151 feet) for disturbance to pinnipeds. Once pile driving begins, SPLs will be recorded at the 10 m (33 ft) and 50 meter (151 feet) contours. The safety zones for marine mammals will then be enlarged or reduced, depending on the actual recorded SPLs. On the first five days of pile driving; field staff will set meters at three distances from the piles being driven at 10 m, 50 m and 100 m. Noise levels will be measured during the entire driving session at these distances for each pile driven the first five days of impact hammer installation of 12 inch wood piles at Pier 19.

Bathymetry for the Pier 19 apron area is relatively consistent showing similar depths across the area where piles will be driving. Measurements will be conducted at two depths: approximately mid water column and a depth near the bottom of the water column but at least 1 m (3 ft) above the bottom. Measurements will be made at other locations either nearer or farther as necessary to establish the approximate distances for the 160 dB and 180 dB ZOIs.

Once the 160 dB and 180 dB ZOIs have been established during the first five days of impact pile driving, the remainder of pile driving will utilize the established distances for visual monitoring of marine mammals. Additional sound monitoring will not be conducted for marine mammal monitoring; only visual observations will be conducted on a daily basis during the remainder of impact pile driving of 12 inch wood piles.

Monitoring for Sound Impacts to Fish

Monitoring will include underwater sound measurements within and at the threshold boundary at which lethal sound impacts are anticipated. As previously stated, the FHWG established sound threshold s are 183 dB for potential impact to fish < 2 grams and 187 dB for fish > 2 grams. The marine mammal monitoring ZOI is significantly less than thresholds set for fish. The sound monitoring to establish ZOIs for marine mammal monitoring will subsume the calculated injury zones related to fish. Sound measurements the first two days will verify whether SPLs are below impact thresholds for fish. Therefore, no additional sound monitoring of impact pile driving will be conducted for fish thresholds as the marine mammal thresholds are lower and more protective.

If any dead or moribund fish are observed during pile driving, they will be collected and identified. NMFS and CDFG will be notified immediately and pile driving operations will be halted for the remainder of the day. Sound monitoring measurements will be initiated the following day when pile driving is initiated within and at the threshold boundary of where lethal sound impacts are anticipated.

2.3 Visual Monitoring of Marine Mammals

ZOI monitoring will be conducted during a minimum of 1/3 of the total vibratory pile driving days and for each day that impact driving occurs. Monitoring of the pinniped and cetacean disturbance zones will be conducted by a qualified NMFS-approved marine mammal observer (MMO). One MMO will be required for the safety zones around each pile-driving site. Accordingly, multiple MMOs will be required if vibratory pile-driving is occurring at multiple locations simultaneously. The MMOs will begin monitoring at least 30 minutes prior to initiation of the pile-driving activities. MMOs likely will conduct monitoring from small boats, existing piers or construction barges. MMOs must be in a location where the full radius of the ZOI is visible (unless part of the radius is under a pier structure).

Observers will survey each shutdown zone to ensure that no marine mammals are seen within the zone before pile-driving of a pile segment begins. If marine mammals are found within the ZOI, pile-driving of the segment will be delayed up to 15 minutes to allow them to move out of the area. If a marine mammal is seen above water and then dives below, the contractor will wait 15 minutes and if no marine mammals are observed in that time it will be assumed that the animal has moved beyond the ZOI.

Monitoring will continue through the pile-driving period and will end approximately 30 minutes after pile-driving have been completed. Observations will be made using binoculars and the naked eye during daylight hours. Marine mammal observers will have night-time infrared scopes or other tools to conduct monitoring during low-light conditions (all impact pile driving will occur during the day). Each member of the monitoring team will have a marine radio or cell phone to contact other observers and work crews. A range finder will be used by the MMO to determine the observation location and distance to marine mammals, boats, and construction equipment.

Data on all observations will be recorded and will include to the extent available, information regarding species, numbers, sex and age class, behavior, time of observation, relative locations of animals to the monitor, and the pile being driven, time that the pile driving begins and ends, any mitigations implemented and other acoustic or visual disturbances. The reactions of marine mammals will be recorded based on the following classifications: 1) no response, 2) head alert (looks towards the source of disturbance), 3) approach water (but does not leave), and 4) flush (leaves a haul-out site). The number of marine mammals under each disturbance reaction will be recorded, as well at the time when seals re-haul after a flush. Appendix A provides the biological data sheets to be used for recording observations.

Visual Monitoring During Vibratory Pile Driving

Once the disturbance zone has been established, MMOs will use this radius for visual monitoring as detailed above. The primary purpose of monitoring the disturbance zone is to document incidents of Level B harassment.

Visual Monitoring During Impact Pile Driving

For all impact pile driving a 10 m radius shutdown zone will be implemented around each pile to avoid exposure of marine mammals to SPLs that could potentially cause injury. This distance subsumes the calculated injury zone of 180 dB for cetaceans (harbor porpoise). This shutdown zone will be monitored by MMOs during all impact pile driving. If a marine mammal enters the shutdown zone (within 10 m), pile driving operations must cease and desist until the marine mammal moves out of the shutdown zone. Pile driving may resume when the marine mammal leaves the shutdown area

As previously stated, the disturbance ZOI of 160 dB will be measured and is anticipated to be an approximately 50 m radius around each pile. MMOs will monitor the disturbance zone and can communicate the presences of marine mammals in the project area but outside the shutdown zone and thus prepare for potential shutdowns of activity. The primary purpose of monitoring the disturbance zone is to document incidents of Level B harassment.

3.0 MONITORING OF RACE EVENTS

America's Cup Race Management will conduct visual monitoring for marine mammals. During 2012 race events and 2013 race events with less than 500 spectator boats (> 50% of expected peak # of spectator boats) monitoring will be conducted by trained AC34 course marshals. During 2013 race events with greater than 500 spectator boats, monitoring will be conducted by course marshals and NMFS approved Marine Mammal Observers (MMO).

Monitoring for cetaceans, will include training, pre-race surveys (60 minutes prior to first race) on days with greater than 500 spectator boats, monitoring during races, post-race surveys (60 minutes after last race) on days with greater than 500 spectator boats, and reporting. With concurrence, America's Cup Race Management will coordinate with Golden Gate Cetacean Research (GGCR) on the following monitoring program.

America's Cup Race Management will coordinate with a senior GGCR staff to advise on the monitoring of cetaceans specifically the harbor porpoise and bottlenose dolphin during 2013 racing events with greater than 500 spectator boats.

Coordination will include the following:

GGCR has trained 94 course marshals for AC34. Any new course marshals shall receive training.

Course marshal training includes education regarding how to identify marine mammals and typical transit or feeding patterns within the race course area and spectator areas.

GGCR to provide one senior staff person to attend weekly briefings during 2013 racing event and provide pertinent information to course marshals for that week. Information may include areas of specific concern related to transit and feeding activities of cetaceans within the proposed race and spectator areas.

A MMO, from the pool of NMFS approved qualified staff, will be positioned on the Golden Gate Bridge during 2013 race events with greater than 500 spectator boats with binoculars during each race (60 minutes before and after racing) to record and report any siting of any cetacean activity.

During 2013 race events with greater than 500 spectator boats at least 10% of those Course Marshals that took the course will be on the water amounting to a minimum of 8 trained AC34 staff on as many marshal boats.

Course marshals will report any dense activity within the 2012 or 2013 race course to GGCR senior staff. GGCR staff will advise as needed on the recommended course of action.

The course marshals and MMOs will communicate observations of cetacean activity within and around the race area to all other race participants and observers via a designated VHF radio Channel 20. For any large whales, observations will be communicated to and amongst course marshals and to relevant advisory staff and a decision will be made regarding delay or postponement of race event. For any small cetaceans, observations will be communicated to and amongst course marshals and to relevant advisory staff and a decision will be made regarding advisory notices to mariners. Any observations of interest (e.g., unusual behaviors) for any marine mammals (including pinnipeds) will be recorded and communicated to GGCR and included in any final reporting. All observations and information will be noted on the attached data sheets.

America's Cup Race Management will submit a report at the conclusion of the 2013 racing events documenting all marine mammal observations. The report will be submitted to the Port, GGCR and NMFS.

4.0 MONITORING OF HELICOPTER OPERATIONS

During helicopter operations at least one MMO will monitor the California sea lion haul-out at Pier 39. Monitoring will be conducted for five days when the helicopter flight patterns are most likely to affect Pier 39 to confirm the estimated Level B Harassment of 250 sea lions per day. If pinnipeds are being disturbed by helicopter operations to a degree similar to that assumed here, additional monitoring must be implemented for at least 1/3 of the total helicopter operation days or 17 days. If pinnipeds at Pier 39 are not being disturbed, or are being disturbed to a much lesser degree than what was assumed in the IHA, monitoring may cease after the first five days of helicopter operations with NMFS concurrence.

As previously stated in Section 1.1 No. 2, helicopter flight restrictions to protect sensitive species will be implemented. Air space within at least 1,000 feet (vertically and horizontally) around Alcatraz Island and above Crissy Beach Wildlife Protection Area as well as avoiding low flying (< 100ft asl) over pinniped haul out areas at Pier 39.

Flight Operations at Treasure Island have specific flight restrictions and approach protocols to avoid impacts to the Yerba Buena haul out for harbor seals.

5.0 MONITORING OF FIREWORKS DISPLAYS

A pre- and post- event census of marine mammals within the acute fireworks impact area (the area where sound, light, and debris effects may have direct impacts on marine organisms and habitats – 500m around fireworks barge; and the California sea lion haul-out at Pier 39.) will be performed. The pre-firework survey will be conducted as close to the actual fireworks display time as possible and must be conducted for no less than 30 minutes and must describe all observed marine mammals and locations.

During each firework display event a MMO will observe pinnipeds at the Pier 39 haul-out and will record any Level B Harassment.

Post-event survey monitoring in the same impact area will occur no later than the morning following the fireworks display and for no less than 30 minutes in duration to record any injured or dead marine mammals.

There are no direct effects anticipated for the least tern as major nesting areas do not occur within the project area.

6.0 PROJECT ORGANIZATION AND RESPONSIBILITIES

Successful execution of this monitoring program will involve close coordination among the Port, ACEA, and the construction contractors, MMOs, and other field personnel. Each project sponsor will hire the appropriately trained field inspectors, and specialty monitors and be responsible for the timely review and reporting of monitoring data to pertinent regulatory agencies and their staff. Because the monitoring program is expected to span several months and possibly up to two years, the procedures for coordinating efforts and exchanging information and data among the regulatory agencies, the Port, ACEA, and other contractors may be refined as more experience is gained throughout the project.

6.1 Qualifications for Sound Measurement Contractor

Any personnel or contractor conducting sound monitoring must have an appropriate bachelor's degree and a minimum of 3 years' experience in noise monitoring and analysis (Experience in the San Francisco Bay is preferred).

6.2 Qualifications for Marine Mammal Observers

In order to be considered qualified to record observations of marine mammals for this monitoring project observers must meet the following criteria:

1) Visual acuity in both eyes (correction is permissible) sufficient for discernment of moving targets at the water's surface with ability to estimate target size and distance; use of binoculars may be necessary to correctly identify the target.
2) Experience and ability to conduct field observations and collect data according to assigned protocols (this may include academic experience)
3) Experience or training in the field identification of marine mammals, including the identification of behaviors.
4) Sufficient training, orientation, or experience with the construction operation to provide for personal safety during observations
5) Writing skills sufficient to prepare a report of observations including but not limited to the number and species of marine mammals observed: dates and times when in water construction activities were documented dates and times when in water construction activities were suspended to avoid potential incidental injury from construction sound of marine mammals observed within a defined shutdown zone and marine mammal behavior.
6) Ability to communicate orally, by radio or in person with project personnel to provide real-time information on marine mammals observed in the area as necessary.

All MMOs must meet at least once for a training session sponsored by the Port and ACEA to discuss implementation of the protocols, identification of marine mammals and reporting requirements. All monitoring personnel will be provided a copy of this monitoring plan and the IHA. Monitoring personnel must read and understand the contents of this plan as well as the IHA as they relate to coordination, communication, and identification and reporting incidental harassment of marine mammals.

6.3 Qualifications for Fish Impact Observers

In order to be considered qualified to record observations of fish for this monitoring project observers must meet the following criteria:

1) Visual acuity in both eyes (correction is permissible) sufficient for discernment of moving targets at the water's surface with ability to estimate target size and distance; use of binoculars may be necessary to correctly identify the target.

2) Experience and ability to conduct field observations and collect data according to assigned protocols (this may include academic experience)

3) Experience or training in the field identification of marine fish, including the identification, sizing, and capture of floating fish.

4) Sufficient training, orientation, or experience with the construction operation to provide for personal safety during observations.

5) Writing skills sufficient to prepare a report of observations including but not limited to the number and species of fish observed: dates and times when in water construction activities were documented dates and times when in water construction activities were suspended.

6) Ability to communicate orally, by radio or in person with project personnel to provide real-time information on fish observed in the area as necessary.

Qualifications of fish observers shall be approved by the CDFG prior to field monitoring.

6.4 Briefings

Prior to the start of any pile-driving activity, a briefing will be held between the construction supervisors and crews, the marine mammal and fish monitoring teams, acoustical monitoring team, and Port or ACEA staff. The purpose of the briefing will be to establish responsibilities of each party, define the chains of command, discuss communication procedures, provide an overview of monitoring purposes, and review operational procedures. The Resident Engineer will have the authority to stop or delay any construction activity, if deemed necessary by the MMOs, noise or fish monitors. New personnel will be briefed before they join the work in progress.

7.0 FIELD SAMPLING AND DOCUMENTATION PROCESSING

This section summarizes the field equipment needed and procedures to be followed for collecting sound data, visual monitoring, and reporting.

7.1 Marine Monitoring Equipment

The following equipment will be used by the MMOs:

- Global positioning system (DGPS) for determining pile location
- A rangefinder capable of achieving an accuracy of ± 5 feet at a range of 100 feet;
- Binoculars;
- Radio or cell phone;
- Field Data Sheets;
- Fish catch net.

The MMOs will set up communications and logistics protocols with the noise monitors and pile driving crews on a site by site basis, to ensure that the ZOIs are clearly defined to all parties, and the shut down notification protocols are well understood.

7.2 Sound Monitoring Equipment

As recommended by CalTrans (2009), measurements are anticipated to be made using hydrophones that have a flat frequency response and are omni-directional over a frequency range of 25 to 10,000 Hz. For example, CalTrans (2009) suggests Reson Model TC-4013 or Model TC-4033 hydrophones with PCB in-line charge amplifiers (Model 422E13) and PCB Multi-Gain Signal Conditioners (Model 480M122) or equivalent systems be used to adjust the received signals to appropriately measure and record the large range of sound pressures that pile driving could generate.

The signals are anticipated to be fed into Integrating Sound Level Meters (SLM) which will measure peak pressure and SEL. Quality recordings using a digital audio recorder (either solid state or tape) would be made at times during attended measurements. As recommended by CalTrans (2009), the SLM is expected to have the ability to measure the un-weighted peak sound pressure levels over relative short periods and is expected to be used to approximate the un-weighted SEL of each pile strike by measuring the one-second equivalent sound energy level (Leq [1-sec]) using the C-weighting network setting or equivalent. All measurement equipment will be required to have a frequency response of +1dB from 10 Hz to 10,000 Hz over the anticipated measurement range and hydrophones of different sensitivities may be required depending on the acoustic environment.

Alternative equipment or measurement procedures may be proposed by the contractor performing the sound monitoring. In this case descriptions and specifications of such equipment/measurement procedures would be provided to NMFS for pre-approval prior to implementation.

7.2.1 Quality Control

Calibration of the sound measurement systems would be established prior to use in the field. Calibration would be performed using the following techniques described by CalTrans (2009) or by alternative techniques that provide the same level of data at the same level of accuracy as proposed by the contractor performing the sound monitoring:

1. Use an acoustically certified piston phone and hydrophone coupler that fits the hydrophone to directly calibrate the measurement system. In this case, the volume correction of the hydrophone coupler using the hydrophone is known so that the piston phone produces a known signal that can be compared against the measurement system response. The response of the measurement system is noted in the field book and applied to all measurements.
2. Use the procedure described in 1 above to calibrate a “reference” hydrophone. The reference hydrophone is then replaced with the field hydrophone used to make actual measurements. Both the field and reference hydrophones would be required to have manufacturer calibration certifications that would include the hydrophone sensitivities. The sensitivity of the field hydrophone would be compared with the sensitivity of the “reference” hydrophone. The difference between the two hydrophones is the offset that would be applied to the measurements made using the “field” hydrophone. With this method, the response of the reference system to the calibration tone is noted in the field book along with the calculated “offset.” The calibration is applied to all measurements made using the “field” hydrophone. This procedure is useful for different model hydrophones that do not fit the piston phone coupler. These types of hydrophones are typically more rugged, and therefore, may be preferable in construction environments.

The SLMs will be calibrated to the calibration tone prior to use in the field. The tone is then measured by the SLM and is recorded on to the beginning of the digital audio recordings that will be used. The system calibration status would be checked by measuring the calibration

tone and recording the tones. The recorded calibration tones are used for subsequent detailed analyses of recorded pile strike sounds.

Field notes will be recorded during all measurements in a water-resistant field notebook and are expected to include calibration notes, measurement positions, pile-driving information, system gain setting, and equipment used to make each measurement.

7.3 Field Documentation

The Port Environmental Compliance Monitor will be responsible for ensuring that field documentation is complete. Documentation of field activities will consist of maintaining a field logbook and completing the appropriate field recording forms associated with the field activities. The field logbook will consist of bound, numbered pages and is intended to provide sufficient data and observations to enable readers to reconstruct events that occurred during the monitoring project.

The field recording forms are intended to provide an efficient means of recording detailed information specific to making observations.

7.3.1 Procedures for Sound Measurement Documentation

Daily sound measurement information should document the following information. The results will be summarized in graphical form and include summary statistics and time histories of impact sound values for each pile. The sound monitoring logs shall include but not be limited to:

a) Size and type of piles.

b) The hammer energy rating used to drive the piles, make and model of the hammer.

c) A description of the sound monitoring equipment.

d) The distance between hydrophone*(s)* and pile.

e) The depth of the hydrophone*(s)* and depth of water at hydrophone locations.

f) The distance from the pile to the water's edge.

g) The depth of water in which the pile was driven.

h) The depth into the substrate that the pile was driven.

i) The physical characteristics of the bottom substrate into which the piles were driven.

j) The total number of strikes to drive each pile and for all piles driven during a 24-hour period.

k) The ambient sound pressure level reported as the 50% CDF.

The results of the hydroacoustic monitoring, ranges and means including standard deviation/error for peak and RMS SPL's, single-strike and cumulative SEL, an estimation of the number of strikes that exceeded the cumulative SEL threshold and an estimation of the distance at which the peak and cumulative SEL values reach the respective thresholds and the distance at which the RMS values reach the relevant fish and marine mammal thresholds and ambient sound levels. Vibratory monitoring results will include the maximum and overall average RMS calculated from 30-second RMS values during the drive of the pile. Values for max/avg rms values for vibratory and peak/avg rms values for impact will be reported for full-power driving only and comparative values from soft starts will also be identified in the reports.

After completion of all pile driving for AC34 project, a final sound monitoring report will be prepared and submitted to the Port for inclusion in the program final report. It will include a summary of all data collected during monitoring activities and will provide the daily field logs

as an attachment. This report will be integrated into the larger final report for this monitoring program.

7.3.2 Procedures for Visual Monitoring Documentation

MMOs will document when Level B Harassment has occurred. Disturbance at haul outs associated with fireworks and helicopter operations can be defined according to a 3-point scale indication severity of behavioral reaction as shown in Table 6-1. The time, source, and duration of the disturbance, and an estimated distance between the source and haul-out should be documented. Only responses falling into Levels 2 and 3 would be considered as harassment under the MMPA under the terms of the IHA.

Table 6-1 – Pinnipeds Response to Disturbance

Level	Type of Response	Definition
1	Alert	Head orientation in response to disturbance. This may include turning head towards the disturbance, craning head and neck while holding the body rigid in a u-shaped position, or changing from a lying to a sitting position. May include slight movement of less than 1 meter.
2	Movement	Movements in response to or away from disturbance, typically over short distances 1-3 meter
3	Flight	All flushes to the water as well as lengthier retreats (> 3 meters)

Source: from Federal Register Vol. 77. No. 106 pg 32588 June 1, 2012
Note: This scale is for monitoring of pinniped disturbance from airborne sound/visual stimuli at haul-outs

Disturbance associated with pile driving can be determined by a comparison of the location of an observed animal, its response behavior and the distance to the relevant threshold as determined by acoustic monitoring.

MMO tasks associated with monitoring and reporting requirements for each of the ongoing project activities are summarized below:

Pile Driving

The following tasks will be conducted by each MMO or MMO team:

- Monitor any marine mammal activity in the vicinity of the pile driving activity
- Establish ZOI distances from pile to be driven
- Monitor shutdown ZOI 30 minutes before pile driving is initiated to ensure marine mammals are not present.
- Observe ZOIs for complete duration of pile drive
- If a marine mammal is within the shutdown zone, pile driving will not be initiated until the marine mammal leaves the shutdown zone of their own volition or until 15 minutes elapse without re-sighting the animal.
- If a marine mammal is seen approaching or entering the shutdown zone during pile driving operations must be discontinued until the animal has moved outside the shutdown zone or until 15 minutes has elapse without re-sighting the animal.
- If a marine mammal is observed within the disturbance zone, a take should be recorded and behaviors documented. (Pile driving may continue if marine mammal is observed within the disturbance zone).
- If marine mammal is observed within the shutdown zone all pile driving must cease until the animal has moved outside the shutdown zone or until 15 minutes has elapse without re-sighting the animal.

- If poor weather conditions affect visibility such that the radius of the shutdown zone (not including under pier area) is obscured, pile driving cannot be initiated until the shutdown zone is visible. Work that has been initiated in conditions of good visibility may continue during poor visibility.

Helicopter Operations

The following tasks will be conducted by the MMO observing Pier 39 during helicopter operations:

- Ensure that a vantage point is established to observe the Pier 39 haul out for the duration of helicopter operations.
- Record all incidents of behavioral responses.

Firework Displays

The following tasks will be conducted by the MMO observing Pier 39 during fireworks displays:

- Conduct pre-survey in potential impact area (500 m radius surrounding firework barge location).
- Ensure that a vantage point is established to observe the Pier 39 haul out for the duration of firework displays.
- Record all incidents of behavioral responses of pinnipeds at Pier 39
- Conduct post survey in potential impact area (500 m radius surrounding firework barge location).

7.3.3 Procedures for Fish Monitoring

Fish monitoring will be performed during all impact pile driving activities for the first 2 weeks of pile driving and will include observation and recording of any occurrence of dead or moribund fish. . The objectives of such monitoring will be to:

- Confirm the presence or absence of dead or moribund fish;
- Document the specific construction activity, location and time occurring;
- Identify size and species of fish affected; and
- Collect and transfer of any dead green sturgeon or salmonids to NOAA-Fisheries.

If after 2 weeks of monitoring, no bird predation or dead fish are observed, the Port will consult with NMFS and CDFG to consider cessation of monitoring.

In accordance with the Terms and Conditions of the project Biological Opinion (NMFS 2012), if any salmonids or sturgeon are found dead or injured during visual observations, NMFS biologist Gary Stern will be contacted immediately by phone at (707) 575-6060 or at the NMFS North Central Coast Office at (707) 575-6050. In addition, Mr. Eric Wilkins at CDFG should be notified at (831) 649-2813. All sturgeon mortalities shall be retained, placed in an appropriately-sized sealable plastic bag, labeled with the date and location of collection, fork length, and be frozen as soon as possible. Frozen samples shall be retained by the monitors or project biologist until specific instructions are provided by NMFS. The biological samples may not be transferred to anyone other than the NMFS Santa Rosa Area Office without obtaining prior written approval from the NMFS North Central Coast Office, Supervisor of the Protected Resources Division. Any such transfer will be subject to such conditions as NMFS deems appropriate.

7.3.4 Daily Reporting Logs

Information will be recorded and submitted to the Port's Environmental Compliance Monitor on a daily basis by either the sound monitoring team and/or the MMOs when pertinent. Each log will provide the following information:

a) Date and location

b) Activity being monitored (e.g., Construction – pile driving for ACEA or Port, helicopter operation or firework display)

c) For pile driving, record the following additional information:

   i. Identify contractor – (Port or ACEA)

   ii. Pile type and size

   iii. Type of driving

   iv. Attenuation device

   v. Duration of drive – time that pile driving begins and ends

   vi. Sound data

   vii. Distances to thresholds

d) Count of all marine mammals observed by species, sex, and age class

e) Marine mammal location within or in relation to the zone

f) Marine mammal reaction (if any) to activities, including direction of movement, and type of activity that is occurring

g) Observations of dead or moribund fish

h) Any acoustic or visual disturbance

i) Environmental conditions (e.g. tide, wind speed, wind direction, visibility, temperature)

j) Finalize Daily Log and submit to Port PM

k) Any mitigations implemented

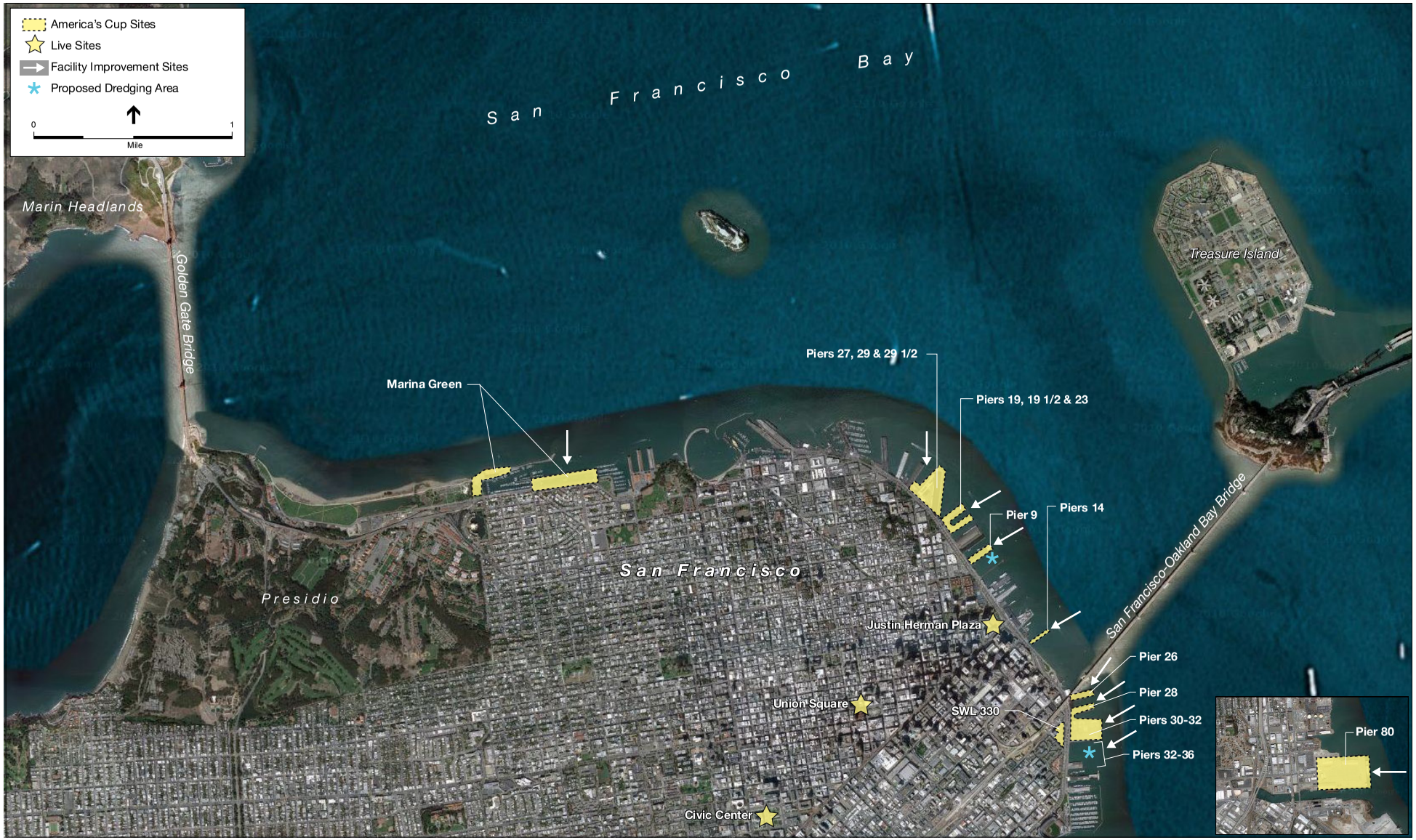
8.0 FINAL REPORTING

A draft report of all activities, sound measurements fish and marine mammal monitoring results will be submitted to the NMFS offices of Protected Resources and Southwest Regional Administrator and the California Department of Fish and Game within 90 days of the expiration of the IHA or 60 days after all project components are completed. Relevant data from other research agencies may also be included in the report. A final report will be prepared and submitted to NMFS within 30 days following receipt of any NMFS' comments on the draft report. Copies of the final report will be issued to all pertinent regulatory agencies by the project sponsors. The final report will include a description of the materials and methods used in monitoring, an overall summary of the project results, and a discussion of the compliance record over the course of the entire program, and a discussion of the effectiveness of monitoring methods.

9.0 REFERENCES

California Department of Transportation (CalTrans). 2009. Final Hydroacoustic Monitoring Plan for Driving of Temporary Access Trestle Piles for the Self-Anchored Suspension Span. File Number EA 0120F3, 04-SF-80 KP 12.2/KP 14.3, 04-ALA-80 KP 0.0/KP 2.1

California Department of Transportation (Caltrans). 2009. Technical Guidance for Assessment and Mitigation of the Hydroacoustic Effects of Pile Driving on Fish. Prepared by ICF Jones and Stokes and Illingworth and Rodkin. Retrieved from http://www.dot.ca.gov/hq/env/bio/files/Guidance_Manual_2_09.pdf.



SOURCE: Google Maps; ESA

Figure 1
Proposed Facility Improvement Sites

APPENDIX A

AC34/CRUISE TERMINAL BIOLOGICAL MONITORING DATA SHEET

FISHERY RESOURCES

Date _____ **Monitor** _____ **Visibility** _____

Tide Level _____ **Human Activity in the Area** _____

Latitude _____ **Longitude** _____

Monitoring Locale: _____

Pile Type: _____

Piles/Day (1-8): ☐ **Pile Driver: Impact** ☐ **Vibratory/Impact** ☐ **Attenuation Device: None** ☐

Minutes of Vibratory Driving : _____

Impact Blows per Pile: _____

Pile No.	Pile Driver (Impact, Vibratory)	Pile Driving Start/End Time	Observer Start/End Time	Dead/Injured Fish Observed (Number/Species)[1]	Dead/Injured Fish Collected (Number/Species/length)	Comment: Reference Number

[1] SH=Steelhead; GS=North American Green Sturgeon; O=Other

AC34/CRUISE TERMINAL BIOLOGICAL MONITORING DATA SHEET

FISHERY RESOURCES

Comment: Reference No.	Fish Species	Life Stage and Status (A,J,L,E,FT,ST, FE,SE,CF, CS)	Comments

A=adult; J=juvenile; L=larva; E=egg; FT = federal threatened; ST=state threatened; FE=federal endangered SE=state endangered; CF = federal candidate; CS=state candidate

AC34/CRUISE TERMINAL BIOLOGICAL MONITORING DATA SHEET

PHOTOS

Comment: Reference No.	Photo Number	Photo Taken Before (B), During (D) or After (A) Pile Driving	Description

AC34/CRUISE TERMINAL BIOLOGICAL MONITORING DATA SHEET

ADDITIONAL COMMENTS

Comment: Reference No.	Additional Comments

AC34/CRUISE TERMINAL BIOLOGICAL MONITORING DATA SHEET

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DIAGRAM

BIOLOGICAL MONITOR _____ _____

Signature **Print Name**

AC34/CRUISE TERMINAL BIOLOGICAL MONITORING DATA SHEET

MARINE MAMMALS

Date _____ Monitor (s) _____ Visibility _____

Tide Level _____ Human Activity in the Area _____

Monitoring Locale: _____

Pile Type: _____

Piles/Day (1-8): ☐ **Pile Driver: Impact** ☐ **Vibratory** ☐

Minutes of Vibratory Driving : _____

Impact Blows per Pile: _____

AC34/CRUISE TERMINAL BIOLOGICAL MONITORING DATA SHEET

MARINE MAMMALS

Pile No.	Pile Driver (Impact, Vibratory)	Pile Driving Start/End Time	Observation Start/End Time	Mammal Species[2]		Comments: Reference Number
				Species	No.	

[2] HS=Harbor Seal; SL = Sea Lion; HP=Harbor Porpoise; GW=Gray Whale; O = Other

AC34/CRUISE TERMINAL BIOLOGICAL MONITORING DATA SHEET

MARINE MAMMALS

Comments: Reference No.	Monitor's Distance from Pile Driving Activity	Initial Behavior of Marine Mammal	Changes in Marine Mammal Behavior (e.g., orientation, speed, diving, respiration rate, etc.)[3]

[3] **Note:** If a monitor sees a marine mammal within or approaching the shut down zone prior to the start of impact pile driving, the monitor will notify the on-site resident engineer (or other authorized individual), who will then be required to delay pile driving until the marine mammal has moved outside of the shut down zone, or if the animal has not been re-sighted within 15 minutes for pinnipeds or 30 minutes for cetaceans. If a marine mammal is sighted within or on a path toward the shut down zone, pile driving will cease until that animal has cleared and is on a path away from the shut down zone, or 15/30 minutes (pinnipeds/cetaceans) has lapsed since the last sighting.

AC34/CRUISE TERMINAL BIOLOGICAL MONITORING DATA SHEET

MARINE MAMMALS

PHOTOS

Comment: Reference No.	Photo Number	Photo Taken Before (B), During (D) or After (A) Pile Driving	Description

AC34/CRUISE TERMINAL BIOLOGICAL MONITORING DATA SHEET

MARINE MAMMALS

ADDITIONAL COMMENTS

Comment: Reference No.	Additional Comments

AC34/CRUISE TERMINAL BIOLOGICAL MONITORING DATA SHEET

MARINE MAMMALS

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DIAGRAM

BIOLOGICAL MONITOR _____ _____

Signature **Print Name**