

## **Appendix E. Mitigation Appendices and Protected Species Management and Equipment Specifications Plan (PSMESP)**

# 1 CONSTRUCTION PLAN FOR IMPACT PILING OF FOUNDATIONS

Atlantic Shores Offshore Wind, LLC (Atlantic Shores) is a 50/50 joint venture between EDF-RE Offshore Development, LLC (a wholly owned subsidiary of EDF Renewables, Inc. [EDF Renewables]) and Shell New Energies US LLC (Shell). On behalf of Atlantic Shores, RPS prepared this Protected Species Management and Equipment Specifications Plan (PSMESP) in support of the submission of the Construction and Operations Plan (COP) to the Bureau of Ocean Energy Management (BOEM) for the development of an offshore wind energy generation project within Lease Area OCS-A 0549 (the Lease Area).

Atlantic Shores' Lease Area is located on the Outer Continental Shelf (OCS) within the New Jersey Wind Energy Area (NJWEA), which was identified by BOEM as suitable for offshore renewable energy development through a multi-year, public environmental review process. Atlantic Shores proposed offshore wind energy generation facilities will be located in Lease Area OCS-A 0549, which is 81,129 acres (328.3 square kilometers [km<sup>2</sup>]) in area. Lease Area OCS-A 0549 is located north of and is adjacent to Atlantic Shores' Lease Area OCS-A 0499.

In addition to the Wind Turbine Area (WTA), the Projects will include two offshore Export Cable Corridors (ECCs) within federal and New Jersey state waters as well as two onshore interconnection cable routes, two onshore substation and/or converter station sites, and a proposed operations and maintenance (O&M) facility in New Jersey. The Offshore Project Area includes the WTA and the ECCs. Mitigation and monitoring zones for impact pile driving have been proposed based on the results of underwater sound propagation modelling.

No impact pile driving is planned for the months of January through April.

## 1.1 Establishment of Monitoring and Mitigation Zones

Mitigation and monitoring zones for Level A harassment are based on modelled, species-specific, exposure ranges. The maximum exposure range was chosen for any piling scenario.

The Level B monitoring zones, which will be applied to all marine mammal species, are based on the largest acoustic ranges for any piling scenario using the NOAA (2005) data source and modelled by JASCO.

The Level A exposure ranges, Level B monitoring zone, mitigation zones, and vessel separation distances for impact pile driving are summarized below in Table 1 below. The mitigation zones are subject to modification based on final engineering design.

These zones and ranges are based on modelled piling scenarios for monopile and jacket pile installation and assume 10 dB broadband noise attenuation. Mitigation zones established for all species, including the North Atlantic right whale (NARW), will be applied accordingly as depicted in the Table. Monitoring zones for Level B behavioral harassment during the Project may be modified, with NMFS approval, based on measurements of the received sound levels during piling operations.

Mitigation and monitoring zones for Level A harassment assume either one or two monopiles driven per day, and either four pre-piled or post-piled pin piles driven per day. When modelled injury threshold distances differed among these scenarios, the largest for each species group was selected for conservatism. The pre-piling clearance zones, referred to as buffer zones, for large whales, porpoise, and seals are based upon the maximum Level A exposure zone for each group. The NARW pre-piling clearance zone was established to be equal to the Level B zone to avoid any preventable exposures. The shutdown zones for large whales, NARW, porpoise, and seals are based upon the maximum Level A zone for each group.

**Table 1: Summary of pre-piling search periods and monitoring and mitigation zones during impact pile driving with a Noise Abatement System (NAS) and 10 dB of attenuation**

	Duration of Clearance search	Buffer zone (m)*	Exclusion zone (m)*	Level B Monitoring zone (m)*	Post-piling monitoring
NARW	30 mins	1,900	1,900	3,900	30 mins
Large whales	30 mins	1,900	1,900	3,900	30 mins
Delphinids	30 mins	1,900	NSD**	3,900	30 mins
Harbor porpoise	30 mins	1,900	1,480	3,900	30 mins
Seals	30 mins	1,900	320	3,900	30 mins
Sea turtles	30 mins	1,900	100	N/A	30 mins

\*NOAA (2005)

\*\*No shutdown required as the modelled level A take distances for all species in the delphinid group are either 0 meters or negligible distances

The mitigation zones are subject to modification based on final engineering design.

## 1.2 Monitoring, Noise Mitigation and Verification, and Mitigation Protocols

A program including monitoring, noise mitigation with field measurement, and verification and implementation of mitigation measures for marine protected species will be implemented during impact pile operations.

Visual and acoustic monitoring will be conducted throughout impact pile driving operations by:

1. Vessel-based visual Protected Species Observers (PSOs) using visual monitoring equipment stationed on the construction vessel and on any secondary marine mammal monitoring vessels.
2. Acoustic monitoring by Passive Acoustic Monitor (PAM) operators in support of the visual PSOs.

A Noise Abatement System (NAS) will be utilized during all piling operations and sound field measurements will be collected as described in the Sound Field Verification Plan to verify the modelled distances to exposure zones and mitigation zones described below.

Mitigation for protected species detected inside the modelled and verified mitigation zones will be implemented by the PSOs and PAM Operators including delays to initiating pile driving activities and shutdown of pile driving activities.

Monitoring and mitigation protocols applicable to impact pile driving activities during construction are described further in the following subsections. Impact pile driving may be initiated after dark or during reduced visibility periods following the protocols described in the Reduced Visibility sections below where utilization of alternative monitoring methods is described.

There will be a team of six to eight visual and acoustic PSOs/PAM Operators on the pile driving vessel, and a team of four to eight visual and acoustic PSOs on any secondary marine mammal monitoring vessel (secondary vessel). PAM operators may conduct monitoring of acoustic systems from a remote shore-based location using real-time streamed data.

A summary of the proposed configuration of monitoring personnel and equipment is provided in Table 2 below.

**Table 2: Summary of protected species monitoring personnel and equipment that will be utilized during pile driving construction operations**

Item	Day time		Reduced Visibility Including Night-Time	
	Pile driving vessel	Support vessel(s)	Pile driving vessel	Support vessel(s)
Number of PSOs on watch	2	2	2	2
Handheld monitoring equipment: reticle binoculars	2	2	2	2
Mounted big-eye binoculars, 25x magnification	1	1	0	0
DSLR camera, 200-300mm lens	2	2	2	2
Number of PAM Operators on watch	1	1	1	1
PAM system monitoring station	1	1	1	1

## 1.3 Visual and Acoustic Monitoring

### 1.3.1 Daytime Visual Monitoring

Visual monitoring will occur from the construction vessel and at least one secondary vessel. Daytime visual monitoring is defined by the period between nautical twilight rise and set for the region. The intent of the visual monitoring program is to provide complete visual coverage of the mitigation zones (buffer and exclusion zones) during impact pile driving using the following protocols:

- During the pre-piling clearance period, throughout pile driving, and 30-minutes after piling is completed, two PSOs will maintain watch at all times on the construction vessel. Two PSOs will also maintain watch from the secondary vessel.
- The total number of PSOs required will be determined by the maximum watch duration followed by break period requirements while also providing adequate long breaks to each person for sleep. Sample watch schedules are provided in the Protected Species Management and Equipment Specifications Plan provided as an appendix to this document.
- During daytime observations, PSOs will monitor the mitigation and monitoring zones with the naked eye and reticle binoculars while periodically scanning using the mounted big eye binoculars.
- The secondary vessel will be positioned and circling between the outer limit of the mitigation zone and the monitoring zone
- There will be a PAM operator conducting acoustic monitoring in conjunction with the visual PSOs during all pre-start clearance periods, piling, and post-piling monitoring periods.

### 1.3.2 Daytime Periods of Reduced Visibility

- During periods of reduced visibility (defined as periods when the monitoring zone is not fully visible), the two PSOs on watch will continue to monitor the mitigation zone utilizing thermal camera systems.
- The PAM Operator will continue acoustic monitoring during all periods of reduced visibility.

### 1.3.3 Night-time Visual Monitoring

- During night-time operations, the two visual PSOs on-watch will rotate with one observing using handheld Night Vision Devices (NVD) and one monitoring the Infrared (IR) thermal imaging camera system.
- The mounted thermal cameras may have automated detection systems or require manual monitoring by a PSO.
- PSOs will focus their observation effort during night-time watch periods within the mitigation zones and waters immediately adjacent to the vessel.
- If possible, deck lights will be extinguished or dimmed during night observations when using the NVDs (strong lights compromise the NVD detection abilities); alternatively, if the deck lights must remain on for safety reasons, the PSO will attempt to use the NVDs in areas away from potential interference by these lights. If a PSO is still unable to observe the required visual zones, piling will not occur.
- The PAM Operator will continue acoustic monitoring during all night-time operations.

### 1.3.4 Passive Acoustic Monitoring

Acoustic monitoring conducted in conjunction with visual monitoring can increase the likelihood of detection of protected species as each monitoring methodology has its limitations. Visual monitoring can be impaired at night or during inclement weather, sea surface conditions can reduce the likelihood of small or unobtrusive species being detected, and animals that submerge for long dives may not be available at the surface for observation. Acoustic monitoring can be limited by other sound sources that may mask marine mammal vocalizations and is limited to detection of animals that are vocalizing below the surface and in range of the hydrophones.

A PAM Operator will conduct monitoring during all search periods prior to initiating piling, during piling and during the post-piling monitoring period.

It is likely that a combination of PAM technologies will be employed during pile installation: towed systems deployed from a vessel and other autonomous systems that will be positioned throughout the monitoring zones where locations will be selected to optimize the acoustic monitoring range of all the systems collectively for all species groups. Mobile systems or systems easy to retrieve and reposition will be selected such that the acoustic monitoring range of the PAM Operators can be adjusted as piling locations change throughout the operation.

PAM will be used to monitor the mitigation zones (buffer and exclusion zones) that correspond to Level A zones and the Level B monitoring zones.

The following acoustic monitoring protocols will be implemented during installation:

- A PAM Operator stationed on at least one of the monitoring vessels alongside the PSO team. Or, with the Operator located remotely/onshore, they will monitor a system deployed on that vessel.
- All PAM Operators actively monitoring will have multiple methods of communication identified to communicate in real time for all PSOs actively monitoring.
- For real-time PAM systems, at least one PAM Operator will be designated to monitor each system by viewing data or data products that are streamed in real-time or near real-time to a computer workstation and monitor located on a Project vessel or onshore.
- A communication flow-chart between PAM Operators and PSOs and installation crew will be established to ensure that all detections requiring mitigation are appropriately communicated in real time.
- Acoustic monitoring during night-time and low visibility conditions during the day will complement visual monitoring (e.g., PSOs and thermal cameras) and will cover an area of at least the Level B zone around each foundation.

## 1.4 Impact Piling Mitigation Measures

Mitigation measures implemented during a piling event include:

- Pre-piling clearance searches
- Soft-start of the pile strikes
- Delays to initiation of pile driving for protected species inside the buffer zones
- Shutdowns of pile driving for protected species inside the exclusion zones
- Monitoring

### 1.4.1 Pre-Piling Clearance Search Period

A 60-minute pre-pile driving clearance search will be conducted before each impact pile driving activity begins at a new installation site. Visual PSOs should begin surveying the monitoring zone at least 60 minutes prior to the start of pile driving. PAM should begin at least 30 minutes prior to the start of piling.

- All marine mammals and sea turtles must be confirmed to be out of the buffer zone prior to initiating soft-start of the pile installation.
- In order to confirm that the buffer zone is clear of marine mammals, the entire zone (1,900 m or as modified) must be fully visible for 30 minutes prior to commencing soft-start.
- If a marine mammal is observed entering or within the buffer zones prior to the initiation of pile driving activity, pile driving activity must be delayed.
- Impact pile driving may commence when either the marine mammal(s) has been visually observed exiting the buffer zone (i.e., has been visually confirmed outside the buffer zone), or, if all of the animals or animal have not been observed exiting the buffer zone, when an additional period of time has elapsed with no further detection inside the buffer zone:
  - 30 minutes have elapsed without redetection for whales, including the NARW, or
  - 15 minutes have elapsed without redetection of dolphins, porpoises, and seals.
  - 30 minutes have elapsed without redetection of sea turtles

## 1.4.2 Soft-Start of Pile Installation

Every monopile installation will begin with a soft-start procedure of a minimum of 20-minute duration.

- Soft-start of pile driving will not begin until the 30-minute search of the buffer zone has been completed by the PSOs and PAM operators on both the construction vessel and the secondary vessel
- PSOs and PAM Operators will confirm clearance of the buffer zone using an established communication flow chart
- The buffer zone (BZ) will be confirmed to be clear for soft-start to begin if no marine mammals or sea turtles were detected inside the BZ during the search
- If any protected species are detected within the BZ prior to the soft-start, then soft-start will be delayed as described in the section above
- Soft-start of the piling operation will be undertaken over a period of no less than 20 minutes where a project-specific procedure will be designed in cooperation with Atlantic Shores and the installation contractor whereby the hammer energy is gradually increased within safe operating parameters.

## 1.4.3 Operations Monitoring

PSOs and PAM Operators will continue active watch of the monitoring zone using visual and acoustic described above throughout the pile installation and for a minimum of 30 minutes after piling has been completed.

## 1.4.4 Shutdown Protocols

If a marine mammal or sea turtle is detected entering or inside the respective exclusion zone after pile driving has commenced, an immediate shutdown of pile driving will be implemented unless Atlantic Shores and/or its contractor determines shutdown is not feasible due to an imminent risk of injury or loss of life to an individual; or risk of damage to a vessel that creates risk of injury or loss of life for individuals.

If shutdown is called for but Atlantic Shores and/or its contractor determines shutdown is not feasible as described above, then hammer energy will be reduced.

After a shutdown, pile driving can resume once the EZs are confirmed by PSOs to be clear of marine mammals and sea turtles using the same clearance procedures as described for initiating pile driving:

- The animal or all of the animals are observed exiting the exclusion zone and are observed outside the exclusion zone OR
- If all of the animals or animal have not been observed exiting the EZ, when an additional period of time has elapsed with no further detection inside the buffer zone:
  - 30 minutes have elapsed without redetection for whales, including the NARW, or
  - 15 minutes have elapsed without redetection of dolphins, porpoises, and seals.
  - 30 minutes have elapsed without redetection of sea turtles

There are two scenarios where Atlantic Shores has identified that imminent risk, as described above, could be a factor: approaching pile refusal and pile instability. Scenarios that would prevent shutdown of piling operations typically have a low likelihood of occurrence.

In a pile refusal scenario, the pile driving sensors indicate that the pile is approaching refusal, where if a shutdown were implemented in this situation, the result could be a stuck pile. Stuck piles pose an imminent risk of

injury or loss of life to an individual, or risk of damage to a vessel that creates risk for individuals. Piling refusal scenarios are unlikely due to the planning that occurs pre-installation where location and sediment conditions are considered, and advanced engineering techniques are used to design piles suited to that location. Real-time data during piling is used to track progress and continuously evaluate whether a cessation would result in a personnel injury risk.

In order to ensure the integrity and stability of the foundation pile can be maintained, environmental conditions and criteria will be established to determine what conditions piling operations may or may not be halted

In order to reduce the likelihood that inclement weather will result in a piling shutdown, weather conditions are assessed in real-time using multiple independent forecasting systems. In addition to ensuring that current weather conditions are suitable for piling, initiation of piling requires a Certificate of Approval by the Marine Warranty Supervisor where this process considers forecasted weather. In an instability scenario where a shutdown is not feasible, piling would continue until a penetration depth is achieved that is sufficient to secure the pile and then the shutdown would be implemented. Piling instability scenarios are most likely to occur early on in the installation, such as during the soft-start period. Soft-start cannot commence until the Certificate of Approval is issued which signals that the current weather window is favorable for installation. In this way it is very unlikely that a pile instability scenario would arise.

#### **1.4.5 Pauses in Piling / “Silent Periods”**

- The EZ will be continuously monitored by PSOs and PAM during any pauses in pile driving.
- If marine mammals are sighted within the EZ during a pause in piling, activities will be delayed until the animal(s) has moved outside the EZ or when 30 minutes have elapsed without re-detection for whales, including the NARW and sea turtles, or 15 minutes have elapsed without re-detection of dolphins, porpoises, and seals.

### **1.5 Vessel Strike Avoidance & Speed Restrictions**

All project-related vessels will adhere to the vessel strike avoidance measures outlined in the Vessel Strike Avoidance section of the PSMESP.

All project-related vessels will adhere to the vessel strike avoidance measures outlined in the Vessel Speed Restrictions section of the PSMESP.

### **1.6 NARW Dynamic Management Area (DMA) Monitoring**

PSOs and PAM Operators will monitor for NARW DMAs as described in that section of the PSMESP.

### **1.7 Data Recording**

Piling and other operations, visual and acoustic monitoring effort, environmental conditions, all marine protected species detections, and any mitigation actions conducted will be recorded.

All data fields outlined as required by NMFS will be collected using standardized data templates that will be provided to all PSO and PAM teams.



## **1.8 Protected Species Detection Sharing Across Vessels**

Protected species detection events will be communicated across PSO teams on all project related vessels where at minimum the species, estimated number of animals, position and heading, if known, will be provided as availability of that information allows

## **1.9 Reporting**

### **1.9.1 Impact Pile Driving Reporting**

Atlantic Shores will follow reporting measures as outlined in the PSMESP.

### **1.9.2 Reporting of DMAs**

DMAs will be reported across all Project vessels as outlined in the PSMESP.

### **1.9.3 Injured and Dead Protected Species Reporting**

The Project will follow reporting measures as stipulated in PSMESP.

### **1.9.4 Noise Attenuation for Impact Pile Driving**

The Project will use a NAS for all piling events and is committed to achieving the modelled ranges associated with 10 dB of noise attenuation.

### **1.9.5 Sounds Measurements During Impact Pile Driving**

Received sound measurements will be collected as described in the Sound Field Verification Plan.

The measurements taken during the field verification will be used to verify the modelled ranges to species group injury and behavioral harassment thresholds and to verify that the 10 dB attenuation has been achieved.

### **1.9.6 Potential Modification of Mitigation Zones**

Based on the sound field measurement results the Project may request a modification of the clearance and exclusion zones.

## 2 OPERATIONS MITIGATION AND MONITORING PROTOCOLS

Visual and acoustic monitoring will be continued long-term through operations to assess any potential impacts on protected species. The surveys conducted before construction will provide baseline data that can be used for comparison to that collected during construction and post construction. A long-term monitoring plan will be created using a combination of the same monitoring methodologies used pre and during construction as well as employing any appropriate new technologies available and applicable to the activity. Operation activities that are expected to be ongoing during construction where visual and/or acoustic monitoring might be employed include maintenance and use of support and transport vessels.

Activities occurring during operations that require monitoring for marine mammals, such as HRG surveys, will follow the protocols outlined in the HRG Survey section of this plan.

### 2.1 Visual Monitoring for Operations

It is expected that during the operations and maintenance phase of the Project, regular maintenance will occur. This will typically involve vessel movement. Crew transfer vessels (CTVs) will transport people and equipment continuously back and forth from port to station, and service operation vessels (SOVs) will remain in the immediate vicinity of the operation and move crew in close transits around the area. During these two types of activities, visual monitoring will occur following protocols described in Section 3.1. Mitigations will be in place to reduce the threat of ship strikes. These are described in detail in Section 3.9. In the event that there may need to be other than routine maintenance (e.g., blade replacement or nacelle work), the same visual methods and protocols will be applied as discussed in Section 5, as appropriate. Acoustic monitoring and appropriate mitigations will be implemented as warranted during operations.

### 2.2 Passive Acoustic Monitoring for Operations

In order to conduct acoustic monitoring for marine mammal during operations ongoing in the WTA, systems that can operate for relatively long periods of time (e.g., months to years) and are capable of monitoring marine mammals over relatively large areas need to be selected. While there are many options currently available, this is an area that is still undergoing significant developments.

Types of acoustic monitoring systems that could be employed during operations include:

- Towed hydrophone arrays that are deployed from a vessel of convenience either locally monitored by an Operator on the vessel or connected to a remote system where data is streamed to a shore-based location for an Operator to monitor
- Autonomous acoustic recorders (AARs), seafloor mounted acoustic recording devices that record and store data for later analysis
- Static PAM buoys for activities that are moored in locations that can strategically selected for their operational or biological importance
- Hydrophone cable systems installed on the seabed
- Steerable craft like gliders, UAVs or ASVs equipped with hydrophone arrays where data is stored and downloaded periodically and/or streamed to shore selectively

Some of the advantages and disadvantages of these system configurations are summarized herein (Table 3).

In general, all of the systems have the capability to be monitored in real time or near real time, with the exception of the acoustic recorders. Systems that require remote monitoring (e.g., buoys or USVs/ASVs) will

require transmission bandwidth where the amount, cost and reliability of the bandwidth will depend on how the system is being used in conjunction with the operation. Machine learning tools can be employed on some of these systems that allow for smaller amounts of data to be transferred, where the triggers for a detection event are usually adjustable to be more conservative, erring on the side of false positive detections but less likely to miss a real detection event. Most of these remote-monitored real time systems also record data, so they can also collect data for post processing. Autonomous acoustic recorders (AARs) that function strictly as data collection tools will also have additional costs associated with data processing after the data is retrieved.

Each system can be used to collect data over a period of weeks to months, but some, like the bottom deployed cable systems require more maintenance and development to increase their monitoring lifespan from weeks to months. AARs can be deployed for months at a time, but since their ongoing functionality cannot be confirmed there is some risk associated with a malfunction early in a deployment resulting in a loss of months of data. Surface buoy systems can be deployed for months but usually require maintenance throughout.

Systems like the recorders and PAM buoys are relatively inexpensive in terms of equipment costs but costs to deploy those systems (e.g., vessels and personnel) need to consider. Systems like the towed hydrophones deployed opportunistically from vessels of convenience have the longest proven track record, lowest cost, and are readily available but are most limited in their acoustic detection capabilities.

The optimal system will depend on a range of factors including data needs, cost considerations, whether the system is being used for project planning or real time mitigation, and in each event, the target species, the length of deployment desired, and how the system will integrate with other operations.

In order to achieve all of the monitoring goals of the project, it is likely that a combination of several systems will be needed and that the configuration of systems will vary throughout the various phases of the project.

**Table 3: Summary of PAM system configurations that may be used to conduct acoustic monitoring during the Project**

System	Advantages	Disadvantages
Towed hydrophone systems	<p>Simple configuration usually consisting of a tow cable with several hydrophone elements and an electronic processing unit with sound cards to process low and mid and high frequency signals</p> <p>Relatively easy to deploy and retrieve</p> <p>Widely used, industry standard technology with long history of use supporting marine industry operations</p> <p>Relatively low cost, readily available</p>	<p>Anticipated that they would be deployed opportunistically from vessels of convenience during operations where their acoustic detection range is usually very limited (hundreds of meters) by the vessel noise</p> <p>Require regular maintenance and are easily damaged</p> <p>Must be deployed and retrieved regularly as required by various vessel operations that may be occurring simultaneous to monitoring</p> <p>Most useful when monitored in real time, requiring a trained and experienced PAM Operator</p>
Bottom mounted acoustic recorders	<p>Simple configuration usually consisting of a single hydrophone element.</p> <p>Relatively easy to deploy and retrieve</p> <p>Relatively low cost, readily available and many manufacturers to choose from, with many providing directly "off the shelf"</p>	<p>Some designs can be vulnerable to disturbance from bottom fishing activities</p> <p>Limitations to data storage can mean there is a trade-off required between frequency bandwidth that can be stored and periods between servicing to download data</p> <p>Data is not accessible in real-time</p> <p>Additional costs associated with deployment and retrieval</p> <p>Since units are not monitored in real time, malfunctions of the recorder can result in loss of data of weeks or months</p>
Moored PAM buoys	<p>Simple configuration usually consisting of 1-2 hydrophone elements</p> <p>Relatively easy to deploy and retrieve</p> <p>Relatively low cost, readily available and many manufacturers to choose between</p> <p>Can be configured to transmit data remotely in real-time or near real time</p>	<p>At risk for damage/loss resulting from vessel activity</p> <p>Suspending multiple hydrophones in water column increases risk of entanglement</p> <p>Additional costs associated with deployment and retrieval</p> <p>Limitations to data storage can mean there is a trade-off required between frequency bandwidth that can be stored and periods between servicing to download data</p> <p>If data is transmitted remotely, there can be significant additional costs associated with securely a reliable long-term transmission network</p> <p>Localization of marine mammals detected not possible without multiple elements</p>
Seafloor cable systems	<p>Multiple omnidirectional hydrophones provide large acoustic detection range for marine mammals with more accurate localization of animals detected, including their movements over time</p>	<p>Permitting for seafloor mounted systems requires advance planning to secure in time</p> <p>System components are more complicated, consisting of moorings, cables and buoys where the purpose-built system</p>

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System	Advantages	Disadvantages
	Higher cost systems provided by a limited number of manufacturers and custom build, requiring longer lead time	may not have been deployed in that particular configuration before and therefore may be vulnerable to unforeseen functionality issues  Requires access to an offshore power source to function at its highest capacity so temporary power sources need to be incorporated until offshore infrastructure is in place that can provide
ASVs, USVs, Gliders	There is a wide range of autonomous vehicles to select from depending on monitoring goals- surface, sub-surface, with varying operational parameters Several models can provide sufficient power to transfer acoustic data in real time such that real-time monitoring could be conducted Several models can be piloted remotely such that they can be adaptively positioned in response to detections made on other systems/platforms Several models have long endurance capabilities, e.g., weeks or months	Many models are relatively “new” to the market with technology that is still undergoing development and therefore do not have a long history /track record in operations  Operating costs for most of these systems are relatively high compared to the static systems

### **3 REGIONAL LONG-TERM MONITORING OF IMPACTS**

A regional long-term monitoring system that can operate for a period of months to years and is capable of monitoring marine mammals throughout the WTA will be established using a combination of acoustic monitoring systems described below.

These long-term autonomous PAM technologies are evolving rapidly and the systems that are available now will continue to develop, and new configurations and hardware are expected to become available.

There are several acoustic monitoring systems available now that can be deployed for long periods of time (e.g., weeks or months) that can be monitored in real-time or where data can be accessed periodically on customizable timeframes depending on the species and environments being monitored.

A combination of these technologies, static and mobile systems, can be employed to create a network that can monitor very large areas (tens of square kilometers for some many of the larger species known to inhabit the WTA).

#### **3.1 Stationary / Fixed Autonomous Recorders**

Stationary systems, used here to refer to those systems that are fixed in one place, either floating and moored or deployed on the seafloor, present advantages for long-term monitoring. There are many different systems commercially available to cover a variety of operating parameters and targeting detection of different species or species groups. These systems can be configured (for example, the frequency range recorded) such that large ranges are monitored for months at a time. Autonomous recorders can be fixed to moored buoys or mounted inside hardware anchored along the seafloor, where there are systems designed to resist entanglement in bottom trawl nets. Data can either be retrieved manually from these systems or can be streamed on communication networks at fixed intervals or as triggered by detection events using machine learning programs with thresholds that can be configured. Some examples of stationary systems are provided in the table in Section 2.2.1.

#### **3.2 Mobile Passive Acoustic Systems**

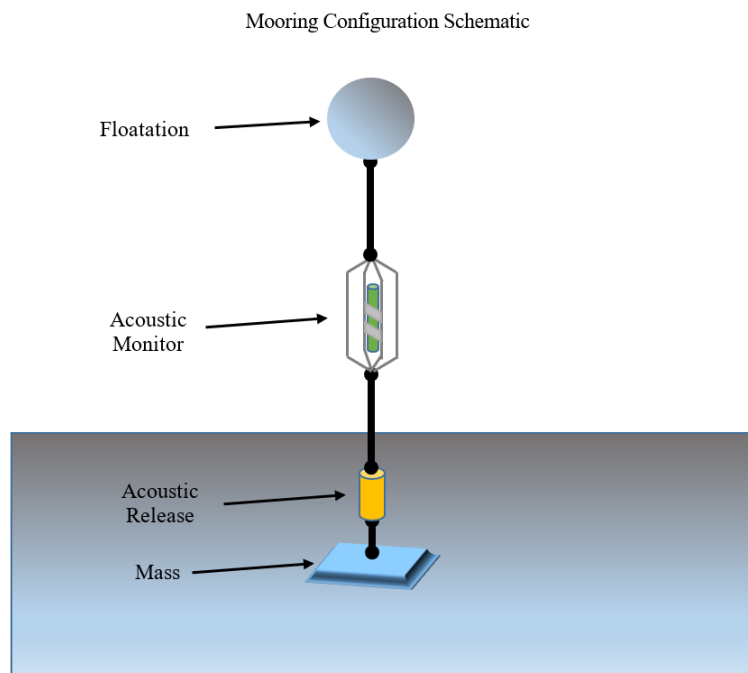
Mobile systems are acoustic systems that are not fixed at one location. Examples of mobile systems include drifting systems and steerable autonomous systems. Drifting systems are unlikely to be practical in an WTA given the expected high volume of vessel activity in addition to the WTA being a defined region where long term monitoring is needed which would necessitate frequent re-positioning of drift buoys.

Steerable autonomous options like gliders and AUVs, ASVs, are significantly more expensive but can be deployed on pre-configured monitoring paths during identified operational or biologicals times of interest and there are fewer limitations to the data that can be collected.

Some examples of mobile systems are provided in the table in Section 2.2.1.

## 4 SOUND FIELD VERIFICATION

Autonomous recording units would be deployed on the seafloor with a weight and acoustic release system which is easily configured to place hydrophones at various depths relative to the seafloor where one unit will contain a hydrophone receiver placed close to the seafloor and the second unit will contain a hydrophone suspended mid-way in the water column. The figure below provides a schematic to demonstrate a typical configuration.



The hydrophones will be calibrated to industry standards, traceable to the US National Institute of Standards and Technology (NIST) laboratory and will be capable of performing radiated noise measurements to accepted national and international standards (ANSI S12.64, ISO 17208-1, and DNV Silent Class).

Each unit will record continuous acoustic data throughout the duration of the field verification across a frequency range of <10Hz up to at least 200 kHz and the data will be saved to a hard-drive located within AMS for post processing.

To validate the estimated sound fields, Sound field verification (SFV) measurements will be conducted during pile driving of the first monopile and first jacket pile installed with noise attenuation activated. In the event that subsequently driven piles are installed that have a larger diameter or are installed with a larger hammer or greater hammer energy, sound field measurements will be conducted for those subsequent piles.

A Sound Field Verification Plan will be submitted to NMFS for review 90 days prior to planned start of pile driving. This plan will describe how Atlantic Shores will ensure that the locations selected are representative of the rest of the piles of that type to be installed and if necessary, how additional sites will be selected for sound field verification, or, how the results from the first pile can be used to predict actual installation noise propagation for subsequent piles. The plan will describe how the effectiveness of the sound attenuation methodology will be evaluated based on the results.

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SFV monitoring will be conducted to determine the distances to the isopleths corresponding to Level A and Level B harassment thresholds, either by extrapolating from *in situ* measurements conducted at several distances from the pile being driven, or by measurements at the distances where the received levels reach the relevant thresholds. To determine the extent of Level B harassment zone verification, the SFV verification report will include the measured or extrapolated distances where the received levels SPLrms decay to 160 dBrms, as well as integration time for such SPLrms.



## **5 PROTECTED SPECIES MANAGEMENT AND EQUIPMENT SPECIFICATIONS PLAN**

# **ATLANTIC SHORES OFFSHORE WIND LLC**

## **Protected Species Management and Equipment Specifications Plan**

with reference to BOEM Lease OCS-A 0499, BOEM NTL 2016-G01, and  
Atlantic Shores Survey Plan

**Prepared by: RPS**  
**For: Atlantic Shores**

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## 5.1 Introduction

Atlantic Shores Offshore Wind LLC (Atlantic Shores) will be conducting high-resolution geophysical (HRG) surveys, and impact piling during construction within Lease Area OCS-A 0499. The details of the survey and construction activities to be executed are provided in the Survey Plan.

The National Oceanic and Atmospheric Administration, National Marine Fisheries Service (NOAA Fisheries) and the Bureau of Ocean Energy Management (BOEM) have advised that sound-producing survey equipment operating below 180 kilohertz (kHz) has the potential to cause acoustic harassment to marine species, in particular marine mammals. NOAA Fisheries and BOEM have also acknowledged vessel strike as a potential risk to marine species. As the proposed survey activities on behalf of Atlantic Shores will be conducted 24-hours per day and include the use of equipment operating below 180 kHz, Atlantic Shores has contracted RPS to develop a Protected Species Management and Equipment Specifications Plan, this document to ensure that marine mammals, sea turtles, and other protected marine species are not adversely affected by equipment noise or vessels.

## 5.2 Applicable Regulatory Documents and Permits

BOEM Lease OCS-A 0499 and the NOAA Fisheries GARFO Programmatic Consultation pursuant to Section 7 of the Endangered Species Act (ESA) contains monitoring and mitigation requirements that apply to marine mammals, marine turtles, and other protected marine species.

NOAA authorized an Incidental Harassment Authorization (IHA) pursuant to Section 101(a)(5) of the MMPA and 50 CFR § 216 Subpart I on April 18, 2022 (which began April 20, 2022 and expires April 19, 2023).

## 5.3 Marine Protected Species

Marine protected species or protected species refers to any marine species for which dedicated monitoring and mitigation procedures will be implemented, including:

- All marine mammals (whales, dolphins, seals, porpoise)
- Sea turtles
- ESA listed sturgeon and giant manta rays

## 5.4 Protected species observers for HRG Survey Operations and Construction Operations

### 5.4.1 Staffing Plan for Survey Operations

A team of four Protected Species Observers (PSOs) will be on board each vessel that will be conducting 24-hour survey operations to undertake visual watches, implement mitigation, and conduct data collection and reporting.

A team of two PSOs will be on board each vessel that will be conducting 12-hour/daylight only survey operations to undertake visual watches, implement mitigation and conduct data collection and reporting.

### 5.4.2 Staffing Plan for Construction Operations

A team of six to eight dual role Passive Acoustic Monitoring (PAM) Operators / PSOs will be on board the construction vessel and the secondary support vessel that will be conducting 24-hour construction operations (impact piling of foundations) to undertake visual and acoustic watches, implement mitigation and conduct data collection and reporting.

### 5.4.3 Roles and Responsibilities for Survey Operations

#### Lead PSO

- Coordinate and Oversee PSO Operations and ensure compliance with monitoring requirements

- Visually monitor, detect, and identify marine mammals and determine distance to source
- Record and report marine mammal sightings, survey activities and environmental conditions according to survey plan
- Monitor and advise on sound source and vessel operations for compliance with the environmental requirements for the survey plan
- Communicate with the crew to implement mitigation actions as required by environmental protocols (including delays to initiation of survey equipment operating below 180kHz)
- Participate in daily meetings and drills with crew when appropriate

#### **PSO**

- Visually monitor, detect, and identify protected species
- Record and report according to survey plan
- Monitor and advise on sound source and vessel operations for compliance with the environmental requirements for the survey plan
- Communicate with the crew to implement mitigation actions as required by environmental protocols
- Participate in daily operation meeting with crew when appropriate

### **5.4.4 Roles and Responsibilities for Construction Operations**

#### **Lead PAM Operator / Environmental Team Lead**

- Coordinate and Oversee PAM and PSO Operations and ensure compliance with monitoring requirements
- Acoustically monitor, detect, and identify marine mammals and determine distance to source
- Record and report marine mammal sightings, construction activities and environmental conditions according to plan
- Monitor and advise on sound source and vessel operations for compliance with the environmental requirements for the plan
- Communicate with the crew to implement mitigation actions as required by environmental protocols (including delays to initiation of all construction equipment)
- Maintain and troubleshoot the PAM system hardware and software
- Oversee all deployments and retrievals of the hydrophone cable
- Participate in daily meetings and drills with crew when appropriate

#### **PAM Operator**

- Acoustically monitor, detect, and identify marine mammals and determine distance to source
- Record and report marine mammal sightings, construction activities and environmental conditions according to plan
- Monitor and advise on sound source and vessel operations for compliance with the environmental requirements
- Communicate with the crew to implement mitigation actions as required by environmental protocols
- Assist Lead PAM Operator in maintaining and troubleshooting the PAM system hardware and software
- Oversee all deployments and retrievals of the hydrophone cable

## **PSO**

- Visually monitor, detect, and identify protected species
- Record and report according to plan
- Monitor and advise on sound source and vessel operations for compliance with the environmental requirements for the plan
- Communicate with the crew to implement mitigation actions as required by environmental protocols
- Participate in daily operation meeting with crew when appropriate

### **5.4.5 PSO Requirements**

All PSOs will have completed a BOEM / National Marine Fisheries Service (NMFS) approved protected species observer training program. PSOs will have relevant observation experience in the Atlantic or Gulf of Mexico. The curriculum vitae (CVs), PSO training certifications and NMFS approval letters of all proposed PSOs will be submitted to Atlantic Shores such that they can be submitted to BOEM for review and approval at least two weeks prior to the start of survey operations.

### **5.4.6 PAM Operator Requirements**

All PAM Operators will have completed a BOEM/NMFS approved protected species observer training program in addition to a PAM Training course. PAM Operators will have relevant observation experience in the Atlantic or Gulf of Mexico. The resumes of all proposed PSOs and PAM operators will be submitted to BOEM for review and approval by NMFS at least 2 weeks prior to the start of survey operations.

## **5.5 Monitoring equipment for HRG Survey Operations**

### **5.5.1 Visual Monitoring Equipment**

#### **5.5.1.1 Day-time monitoring equipment**

The PSO on duty will monitor for marine protected species using the naked eye and hand-held reticle binoculars. Digital single-lens reflex camera equipment will be provided to record sightings and verify species identification.

#### **5.5.1.2 Night-time monitoring equipment**

The PSOs on duty will monitor for marine protected species using night vision goggles that will either be equipped with a thermal clip-on or a hand-held FLIR monocular will be provided. The specifications of this equipment are provided in Appendix A.

PSOs has used this equipment on multiple renewable wind leases and have collected data on the detection distances of various species groups.

Note that this equipment will only be utilized on the vessels conducting 24-hour operations.

#### **5.5.1.3 Distance estimation and calibration of equipment of visual monitoring equipment**

Reticle binoculars have the capability to localize the distance to detected animals.

Monitoring equipment will be calibrated, when possible, throughout the duration of survey using the vessel radar, by comparing estimated distances to known distances and will be conducted during varying sea states and both at night and during the day.

At night, if reticles cannot be used to localize a detection, distance to detected animals will be determined using range finder sticks or by comparing the location of the animal to known distances, such as the length of the vessel.

## 5.6 Monitoring Equipment for Construction Operations

### 5.6.1 Visual Monitoring Equipment

#### 5.6.1.1 Day-time monitoring equipment

The PSO on duty will monitor for marine protected species using the naked eye and hand-held reticle binoculars. Digital single-lens reflex camera equipment will be provided to record sightings and verify species identification.

The PSO on duty will monitor with bigeye binoculars (25/40x) from a pedestal-mounted on the deck of the most appropriate vantage point that provides for optimal observation, PSO safety, and safe operation of the vessel. Bigeye binocular specification can be found in Appendix B.

#### 5.6.1.2 Night-time monitoring equipment

During night-time work, the PSOs on duty will monitor for marine protected species using Morovision PVS-7 Gen 3 PINNACLE night vision goggles (NVDs) with a thermal acquisition clip-on system or forward-looking infrared (IR) monocular, so PSOs can focus observations in any direction.

PSOs have used this equipment on multiple renewable wind leases and have collected data on the detection distances of various species groups. Sea turtles were detected at distances of up to 150 meters and delphinids were detected at distances up to 250 meters.

Note that this equipment will only be utilized on the vessels conducting 24-hour operations.

#### 5.6.1.3 Distance estimation and calibration of equipment of visual monitoring equipment

Reticle binoculars have the capability to localize the distance to detected animals.

Reticle binoculars will be calibrated, when possible, throughout the duration of the survey using the vessel radar, by comparing estimated distances to known distances and will be conducted during varying sea states and both at night and during the day. Calibration requires a clear view of the horizon and cannot be calibrated if the vessel is surrounded by land or reduced visibility.

At night, if reticles cannot be used to localize a detection, distance to detected animals will be determined using range finder sticks or by comparing the location of the animal to known distances, such as the length of the vessel.

### 5.6.2 Acoustic Monitoring Equipment

#### 5.6.2.1 Passive Acoustic Monitoring (PAM) System

The PAM system is designed to provide a flexible approach to the monitoring for marine mammals using a towed hydrophone system. The system uses PAMGUARD software modules such that the optimum system can be configured for the application, vessel, and deployment method. PAM software modules will be configured for the application, vessel, and deployment method.

The support vessel will have two acoustic monitoring systems installed, a primary system and a secondary system available as back-up should any issues be encountered with the main system.

PAM equipment specifications are provided in Appendix C.

Note that this equipment will only be utilized on the vessels conducting 24-hour operations.

The PAM operator must be proficient in its use and PAM must be deployed and functional for use during periods of reduced visibility (including nighttime and day-time fog when exclusion zones [EZs] are obscured) in order to meet the acoustic monitoring requirements of the plan.

The PAM system will be considered to be non-functioning for the purposes of mitigation monitoring in the case of:

- b. Equipment Failure



- If the PAM cable is damaged such that monitoring cannot be undertaken using at least two of the hydrophones, where one must be a low-frequency hydrophone capable of detecting the vocalizations of North Atlantic right whales.
- If the PAM computer is damaged or unable to load or run the acoustic monitoring software properly (i.e., Pamguard, etc.)

**c. Software Failure**

- If the acoustic monitoring software is not functioning

**d. HSE Restriction**

- If sea conditions are too rough for deployment of the hydrophone array

### **5.6.2.2 PAM JSA and PAM Deployment and Retrieval Procedure**

A job safety analysis (JSA) will be completed prior to hydrophone deployment. The PAM Operator will develop, in cooperation with the vessel crew, a vessel-specific deployment and retrieval procedure that considers both the minimization of entanglement risks with other towed equipment while maximizing the acoustic range of the system.

Hydrophone cable deployment is dependent upon operational constraints and the hydrophone towing cable will not be deployed if it hinders safe operations on the vessel; however, no actions allowable with PAM are afforded to the vessel with respect to sound source use during periods of reduced visibility if the PAM system is not operation.

### **5.6.2.3 Distance Estimation of Acoustic Detections**

There are a variety of methods that can be used to estimate the distance to vocalizing marine mammals using the acoustic detection software, Pamguard.

When the distance to a vocalizing animal cannot be determined by Pamguard, the experienced PAM Operator can make a distance estimation assisted by the noise or detection score system developed by Gannier et al. (2002). Gannier et al. monitored sperm whales in the Mediterranean both visually and acoustically. A scale was developed based upon the strength or intensity of the sperm whale clicks at various distances that were then measured when the sperm whales surfaced and were visually observed. Although the scale is subjective, and sounds produced in marine environments will vary according to local conditions, the scale provides a measure for approximating distances when using a single, linear hydrophone array.

## **5.7 Visual monitoring procedures for Survey Operations**

### **5.7.1 Visual Monitoring Watches**

24-Hour Operations Vessels:

- One PSO will be on watch at all times during transit.
- One PSO will be on watch at all times during daylight source operations.
- Two PSO will be on watch at all times during nighttime operations.

12-Hour/Day-light only Operations Vessels:

- One PSO will be on watch at all times during transit.
- One PSO will be on watch at all times during daylight source operations.

The following guidelines will apply to these watch periods:

- Other than brief alerts to bridge personnel of maritime hazards and the collection of ancillary wildlife data, no additional duties may be assigned to the PSO during his/her visual observation watch
- No PSO will be allowed more than four consecutive hours on watch as a visual observer before being allocated a two-hour break from visual monitoring

- No PSO will be assigned a combined watch schedule of more than 12 hours in a 24-hour period

The PSOs will stand watch in a suitable location that will not interfere with the navigation or operation of the vessel and affords an optimal view of the sea surface. PSOs will maintain 360° coverage surrounding the EZs of the vessel.

Visual monitoring will begin no less than 60 minutes prior to the initiation of the sound sources operating below 180kHz and continue until source cease for a significant duration.

If a protected species is observed, the PSO should first take care of any necessary mitigation actions, or if no mitigation actions are required, they will note and monitor the position (including latitude/longitude of the vessel and relative bearing and estimated range to the animal) until the animal dives or moves out of visual range of the observer.

Proposed watch schedules are found in Appendix D.

## **5.7.2 Monitoring During Day-time Reduced Visibility**

During periods of reduced visibility (any time any of the EZs are not fully visible) during the day, the PSO on visual watch will continue observations. There will not be additional PSOs added to augment the visual monitoring until visibility has returned.

## **5.8 Visual and Acoustic Monitoring Procedures for Construction Operations**

### **5.8.1 Visual Monitoring Watches**

24-Hour Operations Vessels:

- One PSO will be on watch at all times during transit.
- Two PSOs will be on watch at all times during daylight operations.
- Two PSOs will be on watch at all times during nighttime operations.

The following guidelines will apply to these watch periods:

- Other than brief alerts to bridge personnel of maritime hazards and the collection of ancillary wildlife data, no additional duties may be assigned to the PSO during his/her visual observation watch
- No PSO will be allowed more than four consecutive hours on watch as a visual observer before being allocated a two-hour break from visual monitoring
- No PSO will be assigned a combined watch schedule of more than 12 hours in a 24-hour period

The PSOs will stand watch in a suitable location that will not interfere with the navigation or operation of the vessel and affords an optimal view of the sea surface. PSOs will maintain 360° coverage surrounding the EZs of the vessel.

Visual monitoring will begin no less than 60 minutes prior to the initiation of the construction sound source and continue until source operations cease for a significant duration.

If a protected species is observed, the PSO should first take care of any necessary mitigation actions, or if no mitigation actions are required, they will note and monitor the position (including latitude/longitude of the vessel and relative bearing and estimated range to the animal) until the animal dives or moves out of visual range of the observer.

Proposed watch schedules are found in Appendix D.

### **5.8.2 Monitoring During Day-time Reduced Visibility**

If visibility is reduced (full exclusion zones are not visible) during daytime, night monitoring equipment (NVDs and thermal IR add on equipment clip on or monocular) will be available to use to augment monitoring. No additional PSOs will be deployed to augment monitoring

If visibility is completely obscured, operations will be suspended until visibility increases.

### 5.8.3 Passive Acoustic Monitoring Watches

On vessels that will be conducting 24-hour operations, one PAM Operator will be on watch during nighttime or periods of reduced visibility, such as fog.

During these observations, the following guidelines shall be followed:

- Other than brief alerts to bridge personnel of maritime hazards no additional duties may be assigned to the observer during his/her acoustic monitoring watch
- No operator will be allowed more than four consecutive hours on watch as a PAM Operator before they will be allocated a break of two hours
- No person on watch as a protected species observer and/or PAM Operator will be assigned a combined watch schedule of more than 12 hours in a 24-hour period

The PAM operator will monitor for marine mammals using the PAM system (headphones for aural monitoring and spectrogram and click detectors for visualization). The PAM operators will be in a suitable location that will not interfere with navigation or the operation of the vessel. The location will provide the PAM operator a comfortable, ergonomic position to monitor the PAM system. The PAM Operator will monitor from a location that allows for a quick exchange of communication to the equipment operator in case of a need for shutdown or delay.

Acoustic monitoring will begin no less than 60 minutes prior to the initiation of the construction operating equipment and continue until operations cease for a significant duration.

**Acoustic monitoring must be consistent, diligent, and free of distractions for the duration of the watch.**

## **5.9 Mitigation procedures: Strike Avoidance for Survey and Construction Operations**

### **5.9.1 Vessel Speed Restriction**

Vessel speed will be restricted to 10 knots or less inside any established Dynamic Management Area (DMA).

### **5.9.2 Separation Distances**

#### **5.9.2.1 North Atlantic Right Whale**

**All survey vessels will maintain a separation distance of 500 meters or greater from any sighted North Atlantic right whale (NARW)**

- If underway, steer a course away from any sighted NARW at 10 knots until the separation distance is achieved
- If sighted within 200 meters to underway vessel, reduce speed and shift the engine to neutral until the NARW has moved beyond 500 meters and out of path, then re-engage engines and steer away at 10 knots

#### **5.9.2.2 Any sighted ESA-listed species (to include sea turtles and giant manta rays) or unidentified large marine mammal visible at the surface**

**All survey vessels will maintain a separation distance of 500 meters or greater from any ESA-listed species or other unidentified large marine mammal visible at the surface.**

#### **5.9.2.3 Non-delphinoid Cetaceans (Baleen whales, Beaked whales, Sperm whales)**

**All vessels will maintain a separation distance of 500 meters or greater from any sighted non-delphinoid (i.e., mysticetes and sperm whales) cetacean, OR large assemblages of delphinoid cetaceans**

- If sighted within 200 meters to underway vessel, reduce speed and shift the engine to neutral until the animal has moved beyond 500 meters

#### **5.9.2.4 Small Cetaceans (Dolphins and Porpoise) and Seals**

**All vessels will maintain a separation distance of 50 meters or greater from any sighted small cetaceans (dolphins and porpoise) and pinnipeds**

- Underway vessel will remain parallel to a sighted delphinoid cetacean's or pinnipeds course whenever possible, avoiding speed or direction changes until the animal has moved beyond 50 meters
- Reduce vessel speed to 10 knots or less when pods (including mother/calf pairs) or large assemblages are observed
- Do not make abrupt changes to vessel course or speed

## **5.10 Mitigation procedures: sound sources for Survey Operations**

### **5.10.1 Survey Equipment Subject to Monitoring and Mitigation Procedures**

Survey equipment that produces sound below 180kHz can be subject to the following monitoring and mitigation protocols. The most up to date guidelines from BOEM and NMFS will be consulted prior to commencement of HRG operations, and the specific list of this equipment will be provided for each survey.

## 5.10.2 Sound Source Exclusion Zones

The following EZs apply to Atlantic Shores survey equipment operating below 180 kHz.

Note that EZs for the purposes of sound exposure mitigation are established around the survey equipment and not around the vessel itself:

- 500 meters: North-Atlantic right whales
- 100 meters: All other ESA-listed species and marine mammals with the exception of voluntarily approaching delphinids as described in Section 8.7
- 100 meters: Sea turtles

Although mitigation will be applied for animals detected in the EZs, observations will extend to the furthest observable distances.

## 5.10.3 Visual Search Periods

To activate any other equipment operating below 180kHz from silence, a minimum of a 30-minute search period must be conducted.

During the daytime, the search must be conducted visually by the PSO on watch.

During nighttime or other periods of reduced visibility, the search must be conducted visually by the PSOs on watch.

**Note that visual observations for all marine protected species will extend to the furthest observable distances even though the above EZs around the sound sources will apply.**

## 5.10.4 Delays to Initiation of the < 180 kHz Sound Sources

If any marine mammal or sea turtle was detected visually inside its respective EZ during the 30-minute search period, initiation of the sound sources operating below 180kHz must be delayed until:

- **All** marine protected species that were observed inside the relevant EZ have been confirmed by the visual observer to have been exiting the relevant EZ
- **OR**
- when a marine protected species was not observed exiting the EZ, an additional time period has elapsed with no further sightings of the animal within the relevant EZ:
  - **15 minutes** for small cetaceans (porpoises and dolphins) and pinnipeds and giant manta rays
  - **30 minutes** for large whales including NARW
  - **30 minutes** for sea turtles

Both the 30-minute pre-clearance search period and the mandatory delay for animals not seen exiting the exclusion zone must be completed before source initiation.

During the day, if at any point during the 30-minute search period, the full EZs were not completely visible, then initiation of the source must be delayed until the full EZ has been visible for a full 30-minute clearance search. To summarize, in order to activate the sub-180 KHz source(s) on a vessel the EZs around the vessel's source must have remained completely visible and clear of marine mammals and sea turtles for the durations described above. Written approval can be made by ASOW to continue operations in reduced visibility conditions.

## 5.10.5 Ramp Up (Soft Start) Procedure

Ramp-up of the sparker will be conducted by gradually increasing the operating level from the smallest setting to the operating level over a period of approximately 20 minutes.

## 5.10.6 Short Breaks in Source Operations

In recognition of occasional short periods of silence for a variety of reasons other than for mitigation, the <180kHz sound sources may be silenced for periods of time not exceeding 20 minutes in duration and may be restarted for operations if:

1. Visual monitoring by PSO is continued diligently through the silent period (during visual surveys, the EZ must remain visible throughout the silent period)  
**AND**
2. No marine protected species are observed in the EZ.

### 5.10.7 Shutdown Procedures

If any marine protected species is sighted at or within its EZ, an immediate shutdown of the survey equipment operating below 180kHz is required.

#### EXCEPT

If delphinids voluntarily approach the vessel (e.g., to bow ride) when the sound sources are at full operating power, those sources can continue to operate; a shutdown is not required. The determination of whether the animal has “voluntarily” approached will be made by the PSO on watch.

The vessel operator must comply immediately with any shut-down request made by a PSO. Any discussion can occur only after the shutdown has been implemented.

**Subsequent restart of the survey equipment may only occur following clearance of the EZ of all marine protected species under the following conditions:**

- When all marine protected species have been confirmed by the visual observer to have been seen exiting the relevant EZ
- **OR**
- When an animal was not observed exiting the EZ, and additional time period has elapsed with no further sightings of the animal within the relevant EZ:
  - **15 minutes** for small cetaceans (porpoises and dolphins) and pinnipeds
  - **30 minutes** for ESA-species, including NARW and sea turtles

### 5.10.8 Mitigation Communication Flowcharts

The mitigation procedures described in this Section of the PSMESSP have been summarized in flowchart form and are provided in Appendix E.

## 5.11 Mitigation procedures For Construction: Impact piling of foundations

### 5.11.1 Exclusion Zones

The following EZs apply to Atlantic Shores impact piling of foundations operating.

	Duration of Clearance search	Buffer zone (m)*	Exclusion zone (m)*	Level B Monitoring zone (m)*	Post-piling monitoring
NARW	30 mins	1,900	1,900	3,900	30 mins
Large whales	30 mins	1,900	1,900	3,900	30 mins
Delphinids	30 mins	1,900	NSD**	3,900	30 mins
Harbor porpoise	30 mins	1,900	1,480	3,900	30 mins
Seals	30 mins	1,900	320	3,900	30 mins
Sea turtles	30 mins	1,900	100	N/A	30 mins

\*NOAA (2005)

\*\*No Shutdown Required

Although mitigation will be applied for animals detected in the EZs, observations will extend to the furthest observable distances.

### 5.11.2 Visual and Acoustic Search Periods

To start any construction operations from silence, a minimum of a 60-minute search period must be conducted.

During the daytime, the search must be conducted visually by the PSO on watch.

During nighttime or other periods of reduced visibility, the search must be conducted visually by the PSOs on watch AND acoustically by the PAM Operator

**Note that visual observations for all marine protected species will extend to the furthest observable distances even though the above EZs around the sound sources will apply.**

### 5.11.3 Delays to Initiation of Construction Operations

If any marine mammal or sea turtle was detected visually or acoustically inside its respective EZ during the 60-minute search period, initiation of the impact piling must be delayed until:

- **All** marine protected species that were observed inside the relevant EZ have been confirmed by the visual observer to have been exiting the relevant EZ
- OR**
- when a marine protected species was not observed exiting the EZ, an additional time period has elapsed with no further sightings of the animal within the relevant EZ:
  - **15 minutes** for small cetaceans (porpoises and dolphins) and pinnipeds and giant manta rays
  - **30 minutes** for large whales including NARW
  - **30 minutes** for sea turtles

Both the 60-minute pre-clearance search period and the mandatory delay for animals not seen exiting the exclusion zone must be completed before source initiation.

During the day, when acoustic monitoring is not being conducted continuously, if at any point during the 60-minute search period, the full Buffer Zones were not completely visible, then either:

1. Initiation of the source must be delayed until the full Buffer Zone has been visible for a full 30-minute clearance search or,
2. A PAM Operator augments the ongoing visual monitoring with acoustic monitoring to conduct the search, if the vessel is equipped with PAM

### 5.11.4 Soft Start Procedure

Soft start of the piling equipment will be conducted by gradually increasing the operating level energy and/or strike rate from the smallest setting to the operating level over a period of approximately 20 minutes. A minimum of 20 minutes or greater until the pile is vertical/self-stability is secured.

### 5.11.5 Short Breaks in Source Operations

In recognition of occasional short periods of silence for a variety of reasons other than for mitigation, the pile driving equipment may be silenced for periods of time not exceeding 30 minutes in duration and may be restarted for operations if:

1. Visual monitoring by PSO is continued diligently through the silent period (during visual surveys, the EZ must remain visible throughout the silent period)
- AND**
2. No marine protected species are observed in the EZ.

### 5.11.6 Shutdown Procedures

If any marine protected species is sighted or acoustically detected at or within its EZ, an immediate shutdown of the piling driving equipment is required.



The operator must comply immediately with any shut-down request made by a PSO or PAM operator. Any discussion can occur only after the shutdown has been implemented.

**Subsequent restart of the equipment may only occur following clearance of the EZ of all marine protected species under the following conditions:**

- When all marine protected species have been confirmed by the visual observer to have been seen exiting the relevant EZ
- **OR**
- When an animal was not observed exiting the EZ, and additional time period has elapsed with no further sightings of the animal within the relevant EZ:
  - **15 minutes** for small cetaceans (porpoises and dolphins) and pinnipeds
  - **30 minutes** for ESA-species, including NARW, and sea turtles

**Of note, if it is determined that a shutdown would cause imminent risk of injury, loss of life to an individual, risk of damage to the vessel or the instability of the pile equipment would cause risk to individuals or vessels, a shutdown is not feasible.**

### 5.11.7 Mitigation Communication Flowcharts

The mitigation procedures described in this Section of the PSMESSP have been summarized in flowchart form and are provided in Appendix E.

## 5.12 Reporting: HRG Survey

### 5.12.1 Data Forms

Standard reporting forms have been approved by, BOEM and NMFS, for use during HRG surveys. These forms will contain, at minimum, all of the data elements listed below, and data will be recorded in the field daily by PSOs (HRG operations) or designated vessel crewmembers (Geotechnical operations).

- Vessel name
- Observers' names and affiliations
- Date and location of survey operations
- Time and latitude/longitude when daily visual survey began
- Time and latitude/longitude when daily visual survey ended; and
- Average environmental conditions during visual surveys, including
  - Wind speed and direction
  - Sea state (glassy, slight, choppy, rough, or Beaufort scale, tidal state)
  - Swell (low, medium, high, or swell height in meters); and
  - Weather conditions (i.e., percent cloud cover, visibility, percent glare); and
  - Overall visibility (poor, moderate, good)
- Species (or identification to lowest possible taxonomic level, sex, age, classification [if known], numbers)
- Certainty of identification (sure, most likely, best guess)
- Total number of animals
- Number of juveniles
- Time and location (i.e., distance from sound source) of observation
- Description (as many distinguishing features as possible of each individual seen, including length, shape, color and pattern, scars or marks, shape and size of dorsal fin, shape of head, and blow characteristics)



- Direction of animal's travel – related to the vessel (drawing preferably)
- Reaction of the animal(s) to relevant sound source (if any) and behavior - as explicit and detailed as possible; note any observed changes in behavior (e.g., avoidance, approach) including bearing and direction of travel; and
- Activity of vessel when sighting occurred.

### 5.12.2 Reporting Observed Impacts to Protected Species

It will be the responsibility of the Lead PSO or designated geotechnical vessel crewmember to report any impacts to an ESA species to NMFS, BOEM and onshore Project Managers as soon as practicably possible but no more than 48 hours of any observations concerning impacts to ESA listed species and no more than 24 hours of the take of any ESA listed species.

The report must include the following information:

- a. Name, telephone, and email of the person providing the report
- b. The vessel name
- c. The Lease Number
- d. Time, date, and location (latitude/longitude) of the incident
- e. Species identification (if known) or description of the animal(s) involved
- f. Vessel's speed during and leading up to the incident
- g. Vessel's course/heading and what operations were being conducted (if applicable)
- h. Status of all sound sources in use
- i. Description of avoidance measures/requirements that were in place at the time of the strike and what additional measures were taken, if any, to avoid strike
- j. Environmental conditions (wave height, wind speed, light, cloud cover, weather, water depth);
- k. Estimated size and length of animal that was struck
- l. Description of the behavior of the species immediately preceding and following the strike
- m. If available, description of the presence and behavior of any other protected species immediately preceding the strike
- n. Disposition of the animal (e.g., dead, injured but alive, injured and moving, blood or tissue observed in the water, last sighted direction of travel, status unknown, disappeared); and
- o. To the extent practicable, photographs or video footage of the animal(s).

The Project Manager will send reports to:

#### **On-board:**

- Onboard Party Chief
- Atlantic Shores Client Representative

#### **On-shore:**

- Project Manager
- Atlantic Shores Permit Manager

### 5.12.3 Injured or Dead Protected Species Reporting

1. The PSO or designated geotechnical vessel crewmember on watch will report the sightings of a dead and/or injured marine species to the onshore project manager, on board client representative and Party Chief.
2. The Lead PSO or designated geotechnical vessel crewmember will report any observed injury or mortality in accordance with NMFS standard reporting guidelines, as well as to the stranding hotline for BOEM and NMFS coordination of proper response. This will occur as soon as practicably possible but no more than 24 hours of the detection
3. A report will be sent to the onshore project manager on the first break.
4. The onshore project manager will submit the report, which will include details of the BOEM and NMFS notifications, to the following distribution list within 12 hours of the detection:

#### On-board:

- Onboard Party Chief
- Atlantic Shores Client Representative

#### On-shore:

- Construction Contractor's Project Manager
- Atlantic Shores Permit Manager
- Atlantic Shores Project Manager

It will be the responsibility of the Atlantic Shores Development Director to provide the report to NOAA and BOEM.

**Unless otherwise directed by BOEM, NOAA Fisheries, or NOAA, the dead or injured marine mammal or sea turtle SHOULD NOT be touched!** Dead and injured marine mammals and sea turtles are still protected by the ESA and the MMPA and touching the animals in any manner is considered harassment and is punishable by law.

### 5.12.4 Daily Progress Report for HRG Operations

A daily detection spreadsheet will be completed and submitted to the Party chief, Atlantic Shores onboard client representative and onshore project manager. If there were no detections that day, the Lead PSO will email the distribution list noting that there were no detections on that day.

### 5.12.5 Final Report for HRG Operations

The PSO team will develop a final report summarizing the Atlantic Shores HRG survey activities and all PSO observations. The onshore Project Manager will provide the finalized report to the Project Manager within 45 days of project completion for review.

The onshore Project Manager will submit the final report to BOEM.

## 5.13 Reporting: Construction Operations

### 5.13.1 Data Forms

Standardized data forms that have been approved by BOEM and NMFS will be utilized during construction operations. These forms will contain, at minimum, all of the data elements listed below, and data will be recorded in the field daily by PSOs and PAM Operators for construction operations.

- Vessel name
- Observers' names and affiliations
- Date and location of survey operation
- Time and latitude/longitude when daily visual survey began
- Time and latitude/longitude when daily visual survey ended; and

- Average environmental conditions during visual surveys, including
  - Wind speed and direction
  - Sea state (glassy, slight, choppy, rough, or Beaufort scale, tidal state)
  - Swell (low, medium, high, or swell height in meters); and
  - Weather conditions (i.e., percent cloud cover, visibility, percent glare); and
  - Overall visibility (poor, moderate, good)
- Species (or identification to lowest possible taxonomic level, sex, age, classification [if known], numbers)
- Certainty of identification (sure, most likely, best guess)
- Total number of animals
- Number of juveniles
- Time and location (i.e., distance from sound source) of observation
- Description (as many distinguishing features as possible of each individual seen, including length, shape, color and pattern, scars or marks, shape and size of dorsal fin, shape of head, and blow characteristics)
- Direction of animal's travel – related to the vessel (drawing preferably)
- Reaction of the animal(s) to relevant sound source construction operations (if any) and behavior - as explicit and detailed as possible; note any observed changes in behavior (e.g., avoidance, approach) including bearing and direction of travel; and
- Activity of vessel when sighting occurred
- Activity of construction operations equipment

### 5.13.2 Reporting Observed Impacts to Protected Species

It will be the responsibility of the Lead PAM Operator to report any impacts to an ESA species to NMFS, BOEM and onshore Project Managers as soon as practicably possible but no more than 48 hours of any observations concerning impacts to ESA listed species and no more than 24 hours of the take of any ESA listed species.

The report must include the following information:

- a. Name, telephone, and email of the person providing the report
- b. The vessel name
- c. The Lease Number
- d. Time, date, and location (latitude/longitude) of the incident
- e. Species identification (if known) or description of the animal(s) involved
- f. Vessel's speed during and leading up to the incident
- g. Vessel's course/heading and what operations were being conducted (if applicable)
- h. Status of all construction equipment in use
- i. Description of avoidance measures/requirements that were in place at the time of the strike and what additional measures were taken, if any, to avoid strike
- j. Environmental conditions (wave height, wind speed, light, cloud cover, weather, water depth)
- k. Estimated size and length of animal that was struck
- l. Description of the behavior of the species immediately preceding and following the strike

- m. If available, description of the presence and behavior of any other protected species immediately preceding the strike
- n. Disposition of the animal (e.g., dead, injured but alive, injured and moving, blood or tissue observed in the water, last sighted direction of travel, status unknown, disappeared); and
- o. To the extent practicable, photographs or video footage of the animal(s).

The Project Manager will send reports to:

**On-board:**

- Onboard Party Chief
- Atlantic Shores Client Representative

**On-shore:**

- Contractor Project Manager
- Atlantic Shores Permit Manager

### 5.13.3 Injured or Dead Protected Species Reporting

1. The PSO on watch will report the sightings of a dead and/or injured marine species to the onshore project manager, on board client representative and Party Chief.
2. The Lead PAM or Lead PSO will report any observed injury or mortality in accordance with NMFS standard reporting guidelines, as well as to the stranding hotline for BOEM and NMFS coordination of proper response. This will occur as soon as practicably possible but no more than 24 hours of the detection
3. A report will be sent to the onshore project manager on the first break.
4. The onshore project manager will submit the report, which will include details of the BOEM and NMFS notifications, to the following distribution list within 12 hours of the detection:

**On-board:**

- Onboard Party Chief
- Atlantic Shores Client Representative

**On-shore:**

- Contractor Project Manager
- Atlantic Shores Permit Manager
- Atlantic Shores Project Manager

It will be the responsibility of the Atlantic Shores Development Director to provide the report to NOAA and BOEM.

**Unless otherwise directed by BOEM, NOAA Fisheries, or NOAA, the dead or injured marine mammal or sea turtle SHOULD NOT be touched!** Dead and injured marine mammals and sea turtles are still protected by the ESA and the MMPA and touching the animals in any manner is considered harassment and is punishable by law.

### 5.13.4 Daily Progress Report for Construction Operations

A daily detection spreadsheet will be completed and submitted to the Party chief, Atlantic Shores onboard client representative and onshore project manager. If there were no detections that day, the Lead PAM or Lead PSO will email the distribution list noting that there were no detections on that day.

### 5.13.5 Weekly Progress Report for Construction Operations

Weekly reports briefly summarizing all visual sightings, acoustic detections and construction activities will be provided to NMFS and BOEM on the Wednesday following a Sunday-Saturday period.

### **5.13.6 Final Report for Construction Operations**

The PSO/PAM team will develop a final report summarizing the Atlantic Shores construction activities and all PSO and PAM observations. The onshore Project Manager will provide the finalized report to the Contractor Project Manager within 45 days of project completion for review.

The Onshore Project Manager will submit the final report to BOEM.

## **Appendix A: Night Monitoring Equipment Specifications**

# Night Monitoring Equipment Specifications

Night monitoring watches were conducted night vision goggles with head mounts and thermal clip-ons or a hand-held FLIR monocular. Regular night vision binoculars work by enhancing the disponible light to allow a brighter image with the use of phosphor screen. The night vision goggles (Figure 1) withstand water immersion and runs on two AA batteries for more than 40 hours. Also provided were three pairs of batteries and a batteries charger with the equipment.



**Figure 1: Night vision goggles with thermal clip.**

The thermal clip on the night vision binocular enabled the capture of infrared light, which provided thermal imaging. The infrared LED handheld is a spotlight that increases the natural radiation that hot subjects emit, making them easier to observe. The infrared lamp used a rechargeable lithium ion battery (Figure 2).

## Night Vision Goggle Technical Specifications

- Generation: 3 U.S.
- Resolution: 64 lp/mm (Min)
- Film: Thin-filmed
- Magnification: 1x
- Field of View: 40°
- Objective Lens: 25mm f/1.2
- Eyepiece Lens EFL: 26 mm
- Diopter Adjustment: +2 to -6
- Interpupillary Adjustment: 55 to 71 mm
- Range of Focus: 20cm to infinity
- Battery Type: Two (2) AA batteries
- Weight w/batteries: 24 oz / 680 grams
- Dimensions: 6 3/8" (L) x 6" (W) x 3" (H)
- Operating Temperature: -51°C to +52° C
- Weather Resistant: Yes
- IR Illuminator: Yes (built in)

## Thermal Acquisition Clip-On Technical Specifications

- Field of View: 20° circular (centered)
- Magnification: 1X, optical unity
- Sensor: 320 x 240 Vox uncooled LWIR microbolometer
- Display Brightness: Adjustable
- Polarity: White hot/black hot
- Calibration: Manual
- Range: Detection – 300m, Recognition – 260m
- Compatibility: PVS-7
- Interface: Standard quick connect
- Battery Type: CR123, 3V lithium
- Battery Life: >3.0 hours (23°C), 2.5 hours (0°C)
- Dimensions: 38 x 64 x 89 mm (W x H x L)
- Weight: 166g with battery

## FLIR Breach Monocular

- Detector type: 320 x 256 VOx Microbolometer
- Refresh Rate: 60 Hz
- Start Up: < 1.5 seconds
- Image Processing: FLIR Proprietary Digital Detail Enhancement™
- Lens System: 9.1 mm; F/1.04
- Optical Magnification: 1×
- Field of View (H x V): 24° × 19°
- Digital e-Zoom: 1× - 4× continuous
- Diopter Adjustment Range: -5 to +5 dpt
- Focusing Range: 0.25 m to infinity
- Eye Relief: 16 mm
- Display: Quad-VGA (1280 x 960) FLCOS
- Video Output: Digital Video
- Internal Memory: Up to 1,000 images and 2.5 hours of video on internal memory
- Temperature Imaging Modes (Image Palettes): White Hot, Black Hot, Rainbow HC, Ironbow, Sepia, Arctic, Outdoor Alert



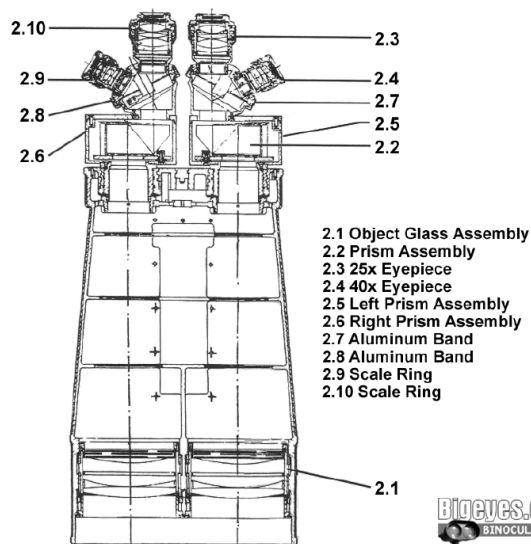
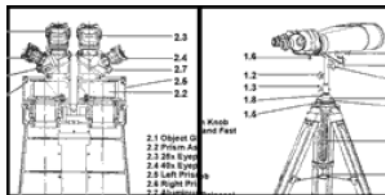
## **Appendix B: Bigeye Binocular Specifications**

## Big Eyes® Specifications:

(All values are approximate)

### 1. Optical Specifications of Binocular:

- Two Magnifications: 25x 40x
- Real Angle of View: 2° 30' 1° 30'
- Real Field of View in Meters @ 1000 Meters 43.64m 26.18 m
- Apparent Angle of View: 62.5° 60.0°
- Minimum Focal Distance (Varies for each user) 50 m 140 m
- Exit Pupil Diameter: 4 mm 2.5 mm
- Eye Relief: 14 mm 8.2 mm
- Interpupillary Distance Range: 58 mm 72 mm
- Relative Brightness: 16 6.5
- Twilight Factor: 50 60.25
- Objective Lens Diameter: 100 mm
- Military Grade - waterproof 1 meter for 3 minutes
- Lens Coating Type: Fully Broadband Multi-coated
- Elevation Angle: 57°
- Depression Angle: 30°
- Azimuth Angle: 360°
- Dimensions: L= 25" W= 8.6" H= 10.9"
- Weight: 26.5 Lbs.

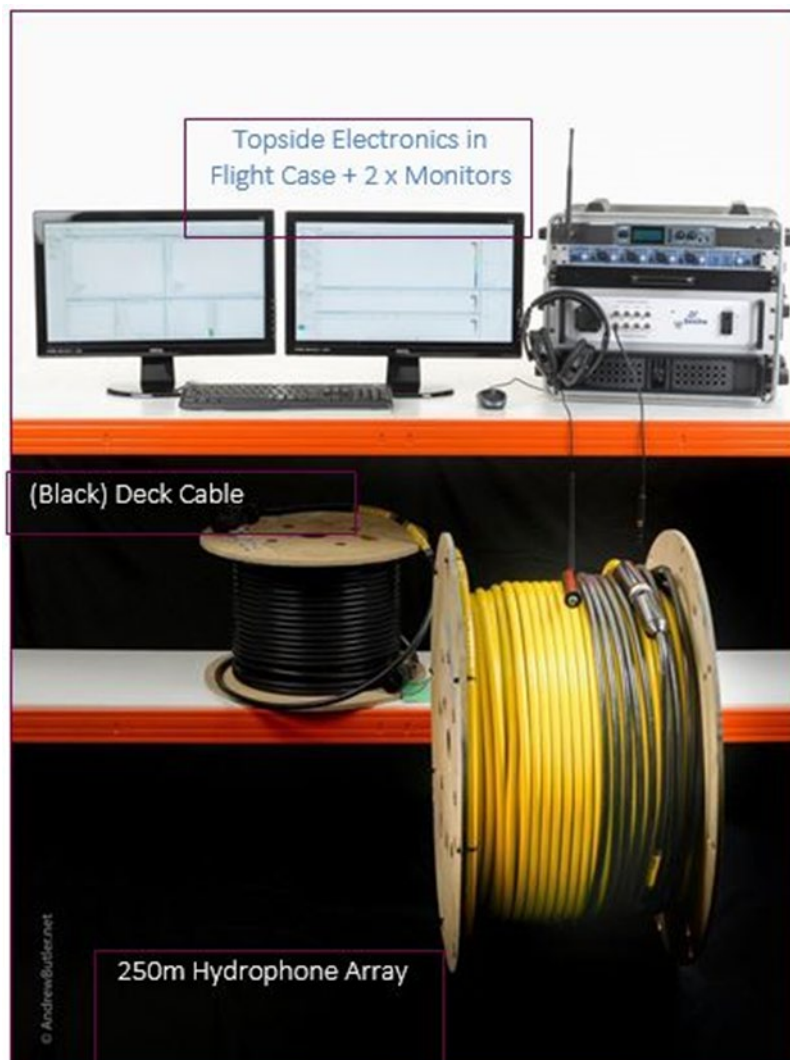


# Appendix C: PAM Equipment Specifications

# Passive Acoustic Monitoring (PAM) Equipment

The PAM equipment comprises the following items:

- 250m Hydrophone Array Cable containing 2 Low Frequency hydrophones (10Hz to 24kHz), 2 Ultra Broadband hydrophones (200Hz to 200kHz), and 2 Broadband hydrophones (2kHz to 200kHz)
- 100m deck cable
- Electronic data capture and processing unit including:
  - Headphones RF transmitter
  - Fireface audio interface
  - Rackmount PC
  - Buffer interface unit
  - Integral screen and keyboard
  - Backup System



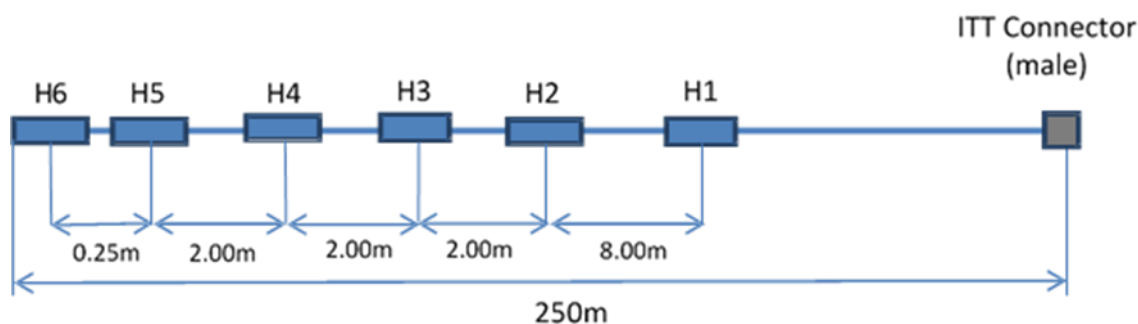
## 6 HYDROPHONE ARRAY

The array includes six hydrophones arranged in three pairs of identical specification with appropriate physical separation to provide direction finding (bearings) to marine mammals and localization using Target Motion Analysis (TMA).

- The front pair (H1 and H2, 8m separation) consists of two “Low Frequency” hydrophones with a response of 10 Hz to 24 KHz.
- The middle pair (H3 and H4, 2m separation) consists of two “Broadband” hydrophones with a response of 200 Hz to 200 kHz.
- The rear pair (H5 and H6, 0.25m separation) consists of two “Standard” hydrophones with a response of 2 kHz to 200 kHz.

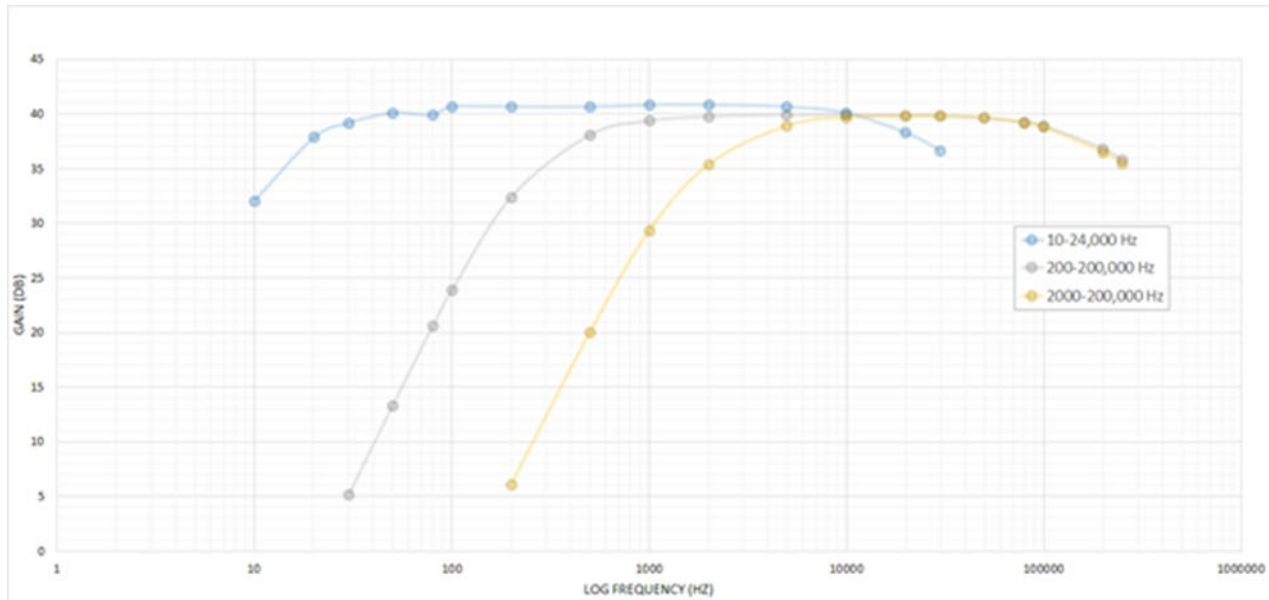
The “Low Frequency” hydrophones are configured to detect very low frequency vocalizations while the “Broadband” and “Standard” hydrophones are configured to detect low-mid frequency and mid-high vocalizations respectively. These three pairs of hydrophones provide the capability to detect the full range of marine mammal vocalizations anticipated to be encountered.

Simulation exercises have been completed using the PAMGuard software to verify that they within-pair separation provides consistently accurate bearings to a range of marine mammal vocalizations. Test signals used in these exercises simulated right whale up-calls, broadband sperm whale clicks, delphinid whistles, and narrow band high frequency harbor porpoise clicks. Anecdotal reports from surveys utilizing Seiche PAM systems with simultaneous visual and acoustic monitoring indicate that the acoustic range estimates have been sufficiently accurate for decision-making on whether vocal animals are within or beyond a 500m mitigation zone.



## Frequency Response Curves

Frequency response curves provide a standard for demonstrating hydrophone sensitivity over a range of frequencies. A flat response between the frequencies of interest is desirable, indicating consistent sensitivity across the band of interest. The frequency response curves provided were generated from 10 Hz to 24 kHz, 200 Hz to 200 kHz, and 2 kHz to 200 kHz hydrophone elements (including pre-amps) of a Seiche towed array and are representative of the response curves for the 6 Hydrophone Array. The frequency response curves for each element within the arrays (main system and spare) used on the survey will be generated as part of the calibration process prior to their dispatch.



**Appendix D: Proposed Watch Schedules**

Proposed Monitoring Scheduled for PSOs Operations: 24-hour HRG Operations

	LOCAL	A	B	C	D	E		LOCAL	PSO	PSO
<b>Night</b>	20:00				PSO	PSO	<b>Night</b>	20:00	E	D
	21:00	PSO			PSO			21:00	A	D
	22:00	PSO			PSO			22:00	A	D
	23:00	PSO	PSO					23:00	A	B
	0:00	PSO	PSO					0:00	A	B
	1:00		PSO	PSO				1:00	B	C
	2:00		PSO	PSO				2:00	B	C
	3:00	PSO		PSO				3:00	A	C
	4:00	PSO		PSO				4:00	A	C
	5:00	PSO	PSO					5:00	A	B
<b>Day</b>	6:00		PSO			FOC	<b>Day</b>	6:00	E	B
	7:00		PSO			FOC		7:00	E	B
	8:00			PSO		FOC		8:00	E	C
	9:00			PSO	FOC			9:00	D	C
	10:00			PSO	FOC			10:00	D	C
	11:00		FOC			PSO		11:00	B	E
	12:00		FOC			PSO		12:00	B	E
	13:00			FOC	PSO			13:00	C	D
	14:00			FOC	PSO			14:00	C	D
	15:00			FOC	PSO			15:00	C	D
	16:00	FOC			PSO			16:00	A	D
	17:00	FOC				PSO		17:00	A	E
	18:00	FOC				PSO		18:00	A	E
	19:00				FOC	PSO		19:00	D	E
	Std. Monitoring Hours	7	7	7	7	6				
	Sleep Break	15	15	14	14	14				
	Fog Monitoring Hours	10	9	10	10	9	<b>Fog On Call (FOC)</b>			
	Sleep Break	10	10	9	10	9				



## Proposed Monitoring Schedule for PSOs Operations: 12-hour HRG Operations

LOCAL TIME	A	B
20:00	PSO	PSO
21:00		PSO
22:00		
23:00		
0:00		
1:00		
2:00		
3:00		
4:00		
5:00		
6:00	PSO	
7:00	PSO	
8:00	PSO	
9:00		PSO
10:00		PSO
11:00		PSO
12:00	PSO	
13:00	PSO	
14:00	PSO	
15:00		PSO
16:00		PSO
17:00		PSO
18:00	PSO	
19:00	PSO	PSO
Watch	7-9	7-9

*Shifts shown in red will be performed by either PSO A or B, depending on the time of sunset (and when watch will terminate). Watches will be divided evenly between the PSOs and such that each person has 11 hrs. off to sleep*

**NIGHT**

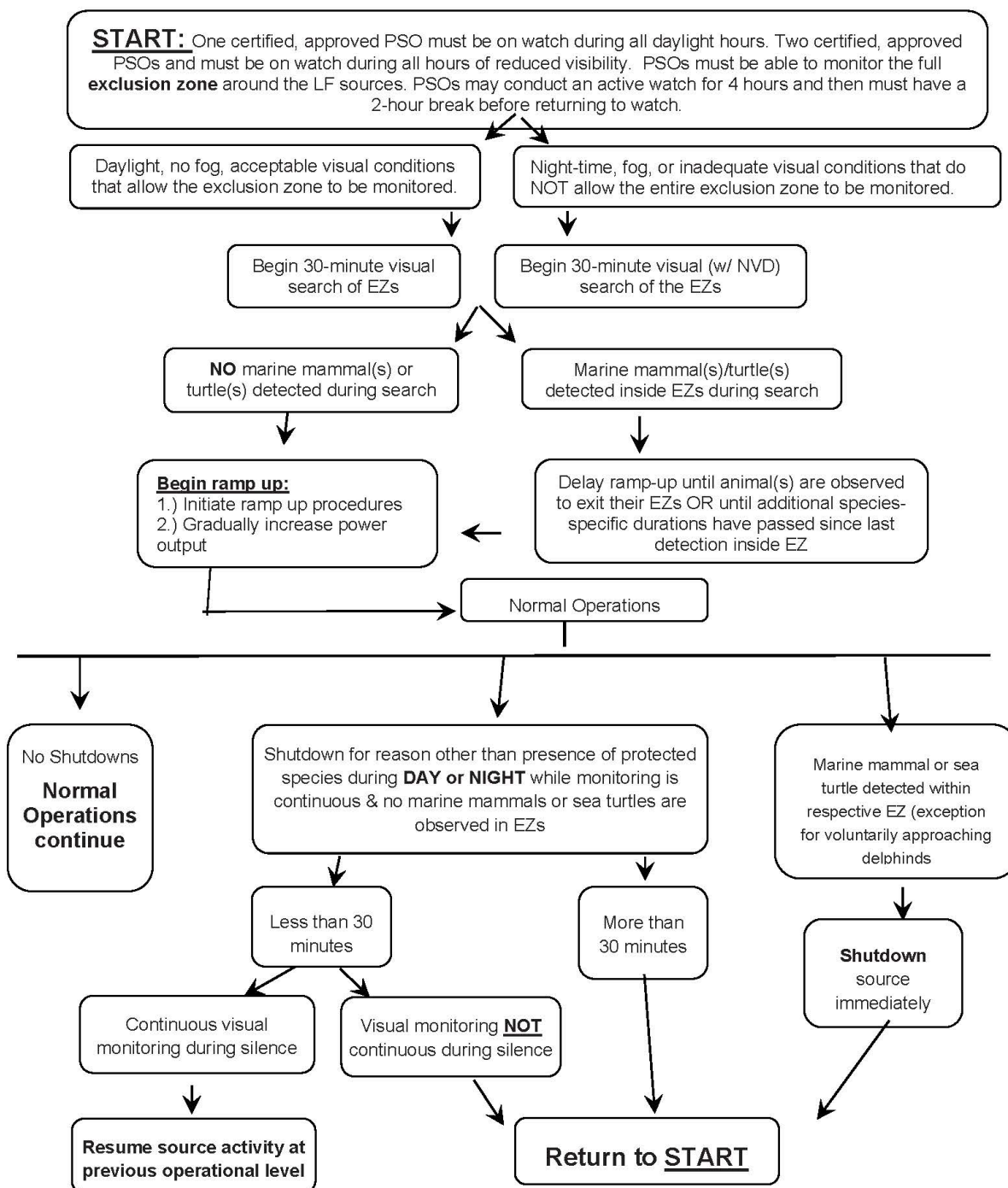
**DAY**

## Proposed Monitoring Scheduled for PSOs Operations: 24-hour Construction Operations

Normal Schedule								FOG Schedule							
	Lead PSO	PSO 2	PSO3	PSO4	PSO5	PSO6	PSO 7		PSO/PAM	PSO/PAM	PSO3	PSO4	PAM/PSO	PAM/PSO	PSO 7
0:00			IR	IR	PAM			0:00			IR		PAM		IR
1:00			IR	IR	PAM			1:00			IR	IR	PAM		
2:00			IR		PAM		IR	2:00			IR		PAM		IR
3:00					PAM	IR	IR	3:00					PAM	IR	IR
4:00				IR		PAM	IR	4:00				IR		PAM	IR
5:00		Visual				PAM	IR	5:00		Visual				PAM	IR
6:00				Visual	Visual			6:00		Visual	Visual		PAM		
7:00			Visual		Visual			7:00	Visual		Visual		PAM		
8:00			Visual			Visual		8:00	Visual	Visual				PAM	
9:00	Meeting	Visual				Visual		9:00		Visual	Visual			PAM	
10:00		Visual	Visual					10:00	Visual		Visual			PAM	
11:00	Visual		Visual					11:00	Visual	Visual				PAM	
12:00		Visual	Visual					12:00	Visual	Visual	PAM				
13:00	Visual		Visual					13:00		Visual	PAM	Visual			
14:00	Visual	Visual						14:00		Visual	PAM	Visual			
15:00	Visual	Visual						15:00	Visual		PAM	Visual			
16:00	Visual	Visual						16:00	Visual			Visual	PAM		
17:00		Visual					Visual	17:00	Visual				PAM		Visual
18:00				Visual			Visual	18:00		Visual			PAM		Visual
19:00				Visual	Visual			19:00				Visual	PAM		Visual
20:00	IR				PAM		IR	20:00				IR		PAM	IR
21:00				IR		PAM	IR	21:00		IR		IR		PAM	
22:00	IR					PAM	IR	22:00	IR				IR	PAM	
23:00	IR			IR		PAM		23:00	IR					PAM	IR
Work	9	8	9	8	8	8	9	Work	10	10	11	9	11	11	10
Sleep	9	11	10	11	11	11	11	Sleep	7	7	8	8	8	8	11

# Appendix E: Communication Flowchart for HRG Survey Operations

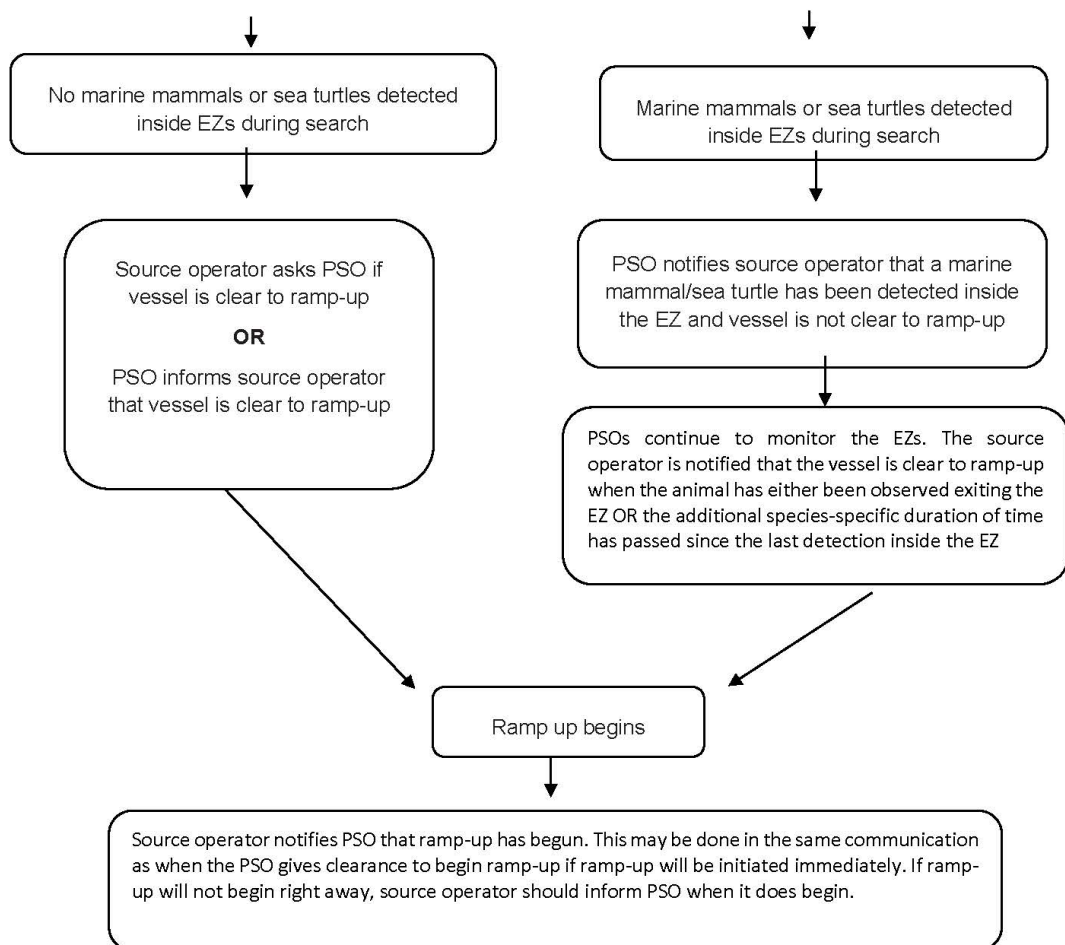
## Mitigation Decision Flowchart for HRG Survey Operations



## Ramp-up Communication Procedure for PSOs

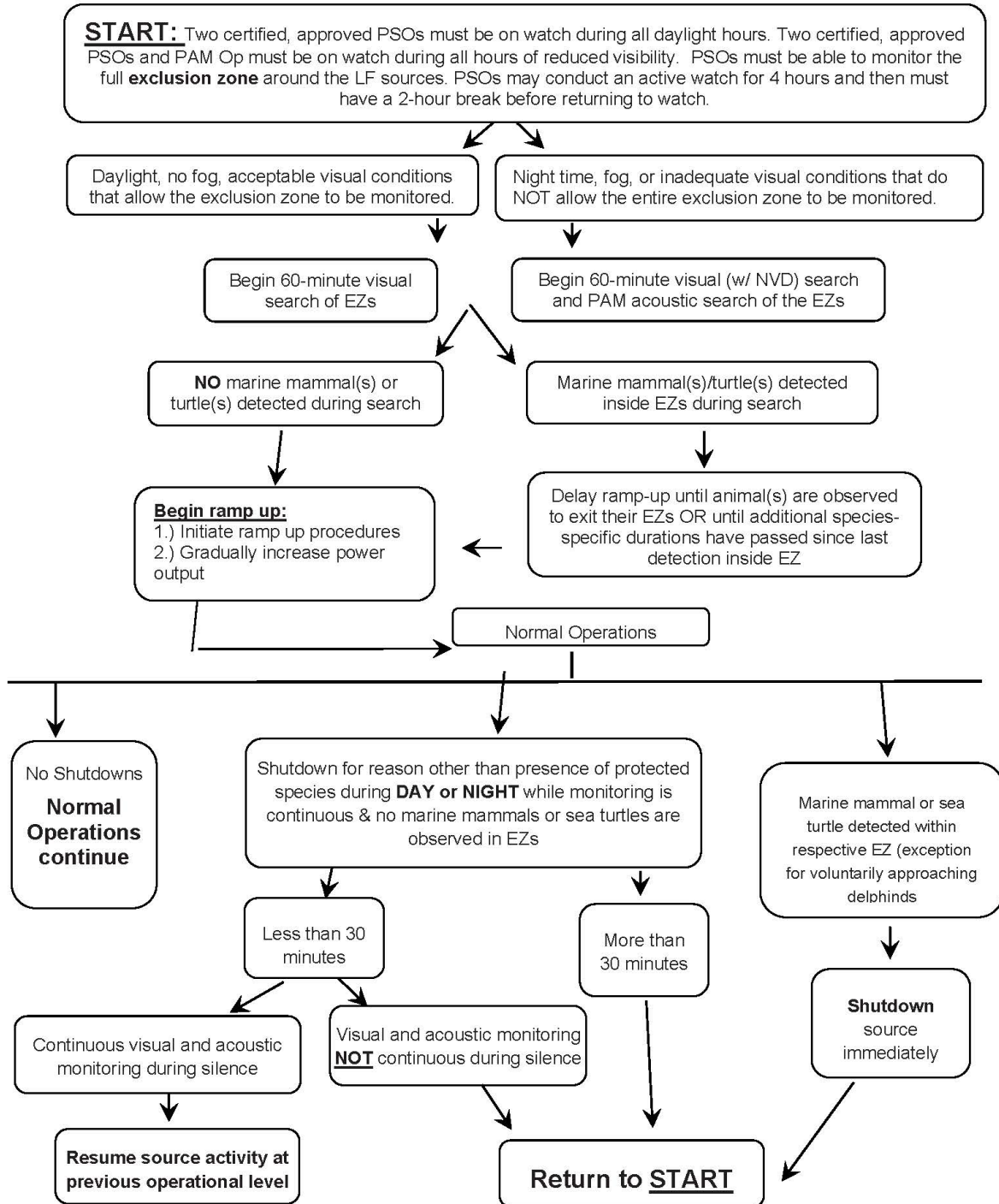
The source operator / observer on duty notifies by phone the PSOs (day) on watch in person, via VHF radio or by phone that the vessel would like to activate the source for ramp-up or source testing at least 60 minutes prior to the intended time of the initiation of the source. *(The operator may notify the PSO more than 30 minutes in advance of the intended source operations, if the initiation time is uncertain (i.e., source testing following array deployment) but **a 30-minute search must be completed** prior to activation of the source.)* After 30 minutes have passed, the source operator / observer calls or radios the PSO on watch to ask if the vessel is clear to initiate ramp-up **OR** after 30 minutes have passed, the PSO informs the source operator / observer via radio that the vessel is clear to initiate ramp-up. Ramp-up begins. Source operator / observer informs PSO that ramp-up has begun.

Source operator/observer requests that PSOs begin 30-minute search to prior to ramp-up or source testing



## **Appendix F: Communication Flowchart for Impact Piling of Foundations**

## Mitigation Decision Flowchart for Impact Piling of Foundations Operations





## Ramp-up Communication Procedure for PSOs and PAM Ops

The source operator / observer on duty notifies by phone the PSOs (day/night) and PAM Ops (night) on watch in person, via VHF radio or by phone that the vessel would like to activate the source for ramp-up or source testing at least 30 minutes prior to the intended time of the initiation of the source. *(The operator may notify the PSO/PAM Op more than 30 minutes in advance of the intended source operations, if the initiation time is uncertain (i.e. source testing following array deployment) but **a 30-minute search must be completed** prior to activation of the source.)* After 30 minutes have passed, the source operator / observer calls or radios the PSO/PAM Op on watch to ask if the vessel is clear to initiate ramp-up **OR** after 30 minutes have passed, the PSO/PAM Op informs the source operator / observer via radio that the vessel is clear to initiate ramp-up. Ramp-up begins. Source operator / observer informs PSO/PAM Op that ramp-up has begun.

