Application

Coastal Virginia Offshore Wind (CVOW) Project

Request for the Incidental Harassment of Marine Mammals Incidental to the Investigation of Unexploded Ordnance (UXO) in the CVOW Offshore Wind Farm Lease Area

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TABLE OF CONTENTS

TABLES

FIGURES

APPENDICES

ACRONYMS AND ABBREVIATIONS

µPa	microPascal
Applicant	Dominion Resources, Inc.
BELLHOP	A beam tracing model for predicting acoustic pressure fields in ocean environments
BOEM	Bureau of Ocean Energy Management
CeTAP	Cetacean and Turtle Assessment Program
CFR	Code of Federal Regulations
cm	centimeter
CVOW	Coastal Virginia Offshore Wind
dB	decibel
DMA	Dynamic Management Area
DoN	U.S. Department of the Navy
Dominion	Dominion Energy
EA	Environmental Assessment
ECM	Environmental Compliance Monitor
ESA	Endangered Species Act
ft	foot
GPS	global positioning system
HF	high-frequency
HRG	high-resolution geophysical
Hz	hertz
IHA	Incidental Harassment Authorization
in	Inch
IUCN	World Conservation Union
km	kilometer
km^2	square kilometer
km/h	kilometer per hour
kHz	kilohertz
knot	nautical mile per hour
LF	low-frequency
m	meter
MF	mid-frequency
mi	mile
MMPA	Marine Mammal Protection Act

nm	nautical mile
NOAA	National oceanic and Atmospheric Administration
NMFS	National Marine Fisheries Service
OCS	Outer Continental Shelf
OPAREA	Operations Area
PSO	Protected Species Observer
PTS	permanent threshold shift
RAP	Research Activities Plan
RMS	root mean square
SEL	sound exposure level
SELcum	cumulative SEL
SL	sound level
SMA	Seasonal Management Area
SPUE	sightings per unit effort
SUA	Special Use Airspace
UXO	unexploded ordnance
VA	Virginia
WEA	Wind Energy Area
ZOI	Zone of Influence

1 DESCRIPTION OF SPECIFIED ACTIVITY

Virginia Electric and Power Company (the Applicant), d/b/a Dominion Energy Virginia (Dominion), is proposing to conduct unexploded ordnance (UXO) investigation surveys off the coast of Virginia in the area of the Research Lease of Submerged Lands for Renewable Energy Activities on the Outer Continental Shelf Offshore Virginia (Lease No. OCS-A-0497) (the Lease Area; Figure 1-1). The Applicant submits this request for Incidental Harassment Authorization (IHA) pursuant to Section 101(a)(5) of the Marine Mammal Protection Act (MMPA) and 50 Code of Federal Regulations (CFR) § 216 Subpart I to allow for the incidental harassment of small numbers of marine mammals resulting from the execution of marine UXO investigation surveys in the Lease Area and export cable corridor specifically associated with the operation of high-resolution geophysical (HRG) survey equipment during upcoming field activities. The objective of this survey is to acquire data regarding the potential presence of UXO within the proposed construction and operational footprints of the Coastal Virginia Offshore Wind (CVOW) Project Area (i.e., export cable construction corridor, inter-array cable area, and wind turbine positions) in accordance with Bureau of Ocean Energy Management (BOEM) Archaeological guidelines and geophysical and geotechnical guidelines:

1. *Guidelines for Providing Archaeological and Historic Property Information Pursuant to 30 CFR Part 585 (March 2017)*
2. *Guidelines for Providing Geophysical, Geotechnical, and Geohazard Information Pursuant to 30 CFR Part 585 (July 2015)*

Both the National Oceanic and Atmospheric Administration (NOAA) and BOEM have advised that sound-producing survey equipment operating below 200 kilohertz (kHz) (e.g., sub-bottom profilers) has the potential to cause acoustic harassment to marine species, in particular marine mammals. This request is being submitted to specifically address survey sound-producing data acquisition equipment that operate below 200 kHz.

The regulations set forth in Section 101(a) (5) of the MMPA and 50 CFR § 216 Subpart I allow for the potential take by incidental harassment of marine mammals by a specific activity if the activity is found to have a negligible impact on the species or stock(s) of marine mammals. In order for the NOAA National Marine Fisheries Service (NMFS) to consider authorizing the taking by U.S. citizens of small numbers of marine mammals incidental to a specified activity (other than commercial fishing), or to make a finding that incidental take is unlikely to occur, a written request must be submitted to the Assistant Administrator. Such a request is detailed in the following sections.

1.1 Survey Activities

The Applicant will conduct marine UXO investigation surveys in the marine environment in the Lease Area and along the cable route corridor between the Lease Area and the Virginia shoreline, located in the lower Chesapeake Bay (see Figure 1-1). The Survey Area is defined as the wind turbine positions, the inter-array cable area and the export cable route corridor to be investigated. Marine UXO investigation surveys will only consist of HRG survey activities. The purpose of the marine UXO investigation surveys are to investigate the potential presence of UXO to occur in the Lease Area and along the export cable route corridor. The offshore portion of the Project Area through which the export cable passes connecting the

offshore wind turbines to the onshore grid facilities is located within the Virginia Capes Range Complex. Given the historical and ongoing munitions training activities within that portion of the Project Area, there is some potential during construction, installation, or maintenance of the Project to encounter and contact UXO and other potentially explosive items that may be on the seabed or in the sediments. This HRG survey is only intended to identify any presence of UXO that occurs in the Lease Area and along the export cable route corridor. No removal of ordinance would be conducted as a part of this survey.

The HRG survey activities will include the following:

- Depth sounding (multibeam depth sounder) to determine water depths and general bottom topography (currently estimated to range from approximately 8 to 40 meters [m], 26 to 131 feet [ft.], in depth);
- Magnetic intensity measurements for detecting local variations in regional magnetic field from geological strata and potential ferrous objects on and below the bottom;
- Seafloor imaging (sidescan sonar survey) for seabed sediment classification purposes, to identify acoustic targets resting on the bottom or that are partially buried;
- Shallow penetration sub-bottom profiler (pinger/chirp) to map the near surface stratigraphy (top 0 to 5 m, 0 to 16 ft., soils below seabed); and
- Medium penetration sub-bottom profiler (sparker) to map deeper subsurface stratigraphy as needed (soils down to 20 m, 66 ft., below seabed).

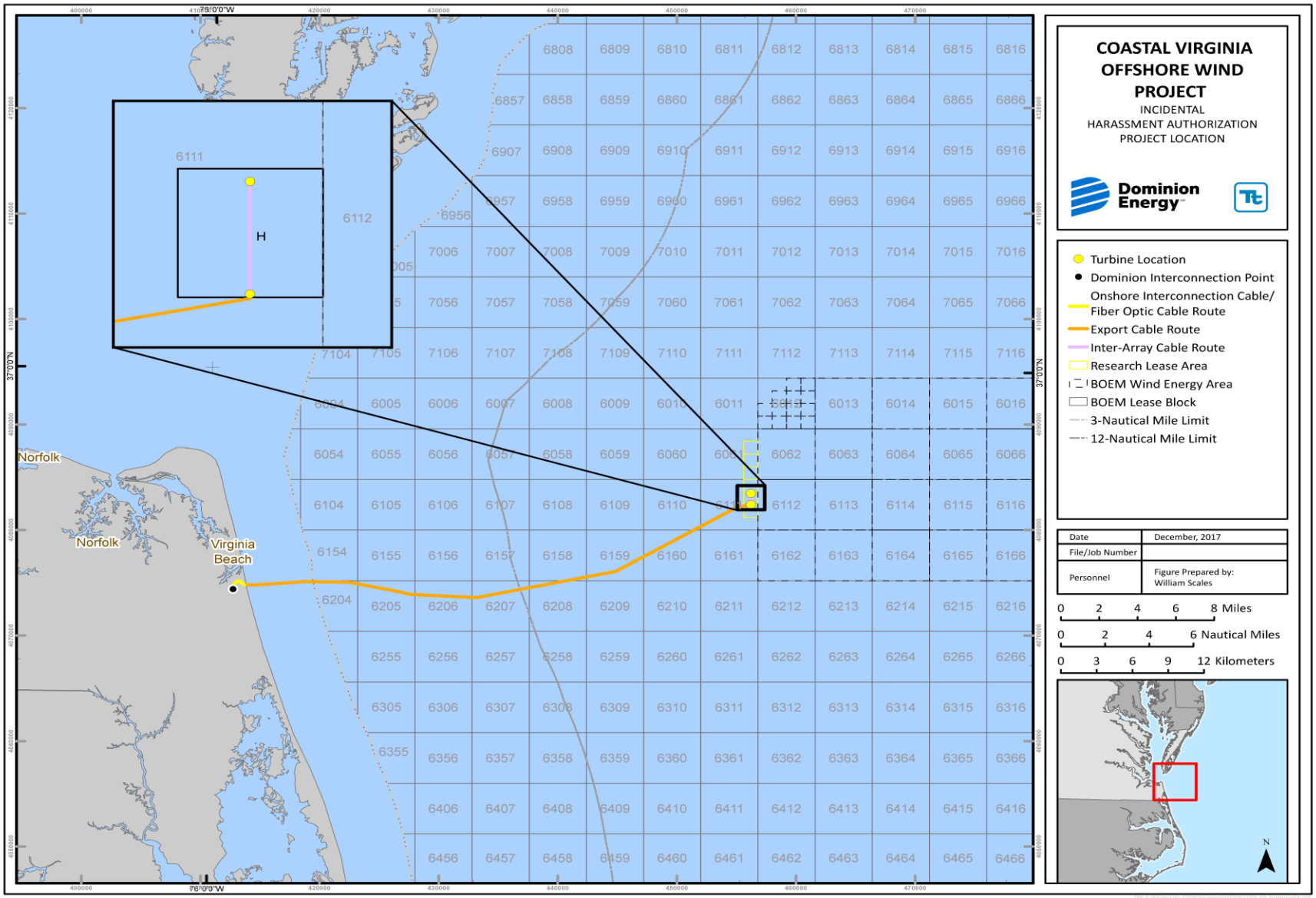

Figure 1-1 Project Location

The HRG surveys are scheduled to begin no earlier than August 1, 2018. Table 1-1 identifies the representative survey equipment that is being considered in support of the proposed HRG survey activities. The make and model of the listed HRG equipment may vary depending on availability, but will be finalized as part of the survey preparations and contract negotiations with the survey contractor, and therefore the final selection of the survey equipment will be confirmed prior to the start of the HRG survey program. None of the proposed HRG Survey activities will result in the disturbance of bottom habitat in the Lease Area or along the export cable route corridor.

Table 1-1 Summary of Proposed HRG Survey Data Acquisition Equipment

Representative HRG Survey Equipment	Operating Frequencies	Source Level Reported by Manufacturer	Beamwidth (degree)	Pulse Duration (millisec)
Sonardyne Ranger 2 USBL	35-50 kHz	200 dB_{peak}	180	1
Klein 300H Sidescan Sonar	445/900 kHz*	242 dB_{RMS}	0.2	0.0025 to 0.4
GeoPulse Sub-bottom Profiler	1.5 to 19 kHz	208 dB_{RMS}	55	0.1 to 1
Geo-Source 600/800	50 to 5000 Hz	221 dB_{RMS}/217 dB_{RMS}	110	1 to 2
SeaBat 7125 Multibeam Sonar	200/400 kHz*	220 dB_{peak}	2	0.03 to 0.3
Innomar Medium 100 Sub-bottom Profiler	85 to 115 kHz	243 dB_{RMS}/250 dB_{peak}	1	0.07 to 2
**Note: Operating frequencies are above all relevant marine mammal hearing thresholds and therefor these HRG systems were not directly assessed within this IHA.*				

The HRG survey activities will be supported by up to two survey vessels within the Lease Area and along the proposed export cable route corridor. Assuming a maximum survey track line to fully cover the Survey Area, the assigned vessels will be sufficient in size to accomplish the survey goals in specific survey areas and capable of maintaining both the required course and a survey speed of approximately 4.0 nautical miles per hour (knots) while transiting survey lines. While survey tracks could shorten, the maximum survey track scenario has been selected to provide operational flexibility. These vessels will survey the following segments:

- Turbine Positions –The estimated working area is two (2) 1 km x 1 km boxes;
- Export Cable Route Corridor – The estimated working area is 43 km (length) by 300 m (width); and
- Inter-Array Cable Area – The estimated working area is 2 km (length) by 300 m (width).

The aforementioned survey segments are collectively referred to herein as the Survey Area. If necessary, a small, shallow draft vessel will be used for nearshore cable route segments in shallow water.

To minimize the cost, the duration of survey activities, and the period of potential impact on marine species, the Applicant has proposed conducting continuous HRG survey operations 24 hours per day for offshore survey locations. For shallow, nearshore areas, a small vessel with a draft sufficient to survey shallow waters (up to 72 ft. [22 m]) will be needed. Only daylight operations will be used to survey short cable route segments nearshore. As a conservative measure, based on 24-hour operations, the estimated duration of the

survey activities would be up to three (3) months (including estimated weather down time).

As noted previously, both NOAA and BOEM have advised that the deployment of HRG survey equipment including the use of sound-producing equipment operating below 200 kHz (e.g., sub-bottom profilers) has the potential to cause incidental acoustic harassment to marine species, in particular marine mammals. It should be noted that, while not included in Table 1-1, ultra-short baseline (USBL) and global acoustic positioning system (GAPS) equipment have become vital to HRG surveys to determine exact location of survey equipment and to provide added measures of safety to prevent gear entanglement and bottom contact. This type of gear does not have the capability to ramp up or be turned down in power. In addition, past analysis for similar HRG surveys shows level A isopleths only within a few meters and have resulted in no Level A interactions. Use of such systems is unlikely to result in the harassment of marine mammals and, therefore, were not included in the subsequent analysis. Based on the frequency ranges of the potential equipment to be used in support of the HRG survey activities (Table 1-1) and the hearing ranges of the marine mammals that have the potential to occur in the Lease Area and export cable corridor during survey activities (Table 1-2), the survey activities that have the potential to cause harrassment as defined by the MMPA include the noise produced by the 800 kJ Geo-Source (160 dB_{rms} re 1 µPa), the GeoPulse Sub-bottom Profiler, and the Innomar Medium 100 sub-bottom profiler. Level A harassment may occur at distances from the Innomar Medium 100 sub-bottom profiler solely for High-Frequency (HF) cetaceans such as the harbor porpoise. For the Low- (LF) and Mid- frequencies (MF), Level A harassment would only potentially occur very close to the HRG source (within 16 ft [5 m]).

1.2 Survey Activities Resulting in the Potential Take by Incidental Harassment of Marine Mammals

The potential effects of underwater noise resulting in potential take by incidental harassment of marine mammals are federally managed by NOAA under the MMPA to minimize the potential for both harm and harassment. Under the MMPA, Level A harassment is statutorily defined as any act of pursuit, torment, or annoyance that has the potential to injure a marine mammal or marine mammal stock in the wild; however, the actionable sound pressure level is not identified in the statute. Level B harassment is defined as any act of pursuit, torment, or annoyance that has the potential to disturb a marine mammal or marine mammal stock in the wild by causing disruption of behavioral patterns, including, but not limited to, migration, breathing, nursing, breeding, feeding, or sheltering.

In July of 2016, NMFS finalized the Technical Guidance for Assessing the Effect of Anthropogenic Sound on *Marine Mammals*. Under this new NMFS guidance, Level A harassment is said to occur as a result of exposure to high noise levels and the onset of permanent hearing sensitivity loss, known as a permanent threshold shift (PTS). This revision to earlier NMFS guidelines is based on findings published by the Noise Criteria Group (Southall et al., 2007). For transient and continuous sounds, it was concluded that the potential for injury is not just related to the level of the underwater sound and the hearing bandwidth of the animal, but is also influenced by the duration of exposure. The evaluation of the onset of PTS provides additional species-specific insight on the potential for affect that is not captured by evaluations completed using the previous NMFS thresholds for Level A and Level B harassment alone.

Frequency weighting provides a sound level referenced to an animal's hearing ability either for individual species or classes of species, and therefore a measure of the potential of the sound to cause an effect. The

measure that is obtained represents the perceived level of the sound for that animal. This is an important consideration because even apparently loud underwater sound may not effect an animal if it is at frequencies outside the animal's hearing range. In the NMFS final guidance document, there are five hearing groups: LF cetaceans (baleen whales), MF cetaceans (dolphins, toothed whales, beaked whales, bottlenose whales), HF cetaceans (true porpoises, Kogia, river dolphins, cephalorhynchid, *Lagenorhynchus cruciger* and *L. australis*), Phocid pinnipeds (true seals), and Otariid pinnipeds (sea lions and fur seals). It should be noted that Otariid pinnipeds do not occur within the Survey Area.

There are specific hearing criteria thresholds provided by NMFS for each functional hearing group. These criteria apply hearing adjustment curves for each animal group known as M-weighting (see Table 1-2).

Table 1-2 M—Weighted PTS Criteria and Functional Hearing Range for Marine Mammals (NMFS, 2016)

Functional Hearing Group	PTS Onset Impulsive	PTS Onset Non-Impulsive	Functional Hearing Range
LF cetaceans (baleen whales)	219 dB_{peak} & 183 dB SEL_{cum}	199 dB SEL_{cum}	7 Hz to 35 kHz
MF cetaceans (dolphins, toothed whales, beaked whales, bottlenose whales)	230 dB_{peak} & 185 dB SEL_{cum}	198 dB SEL_{cum}	150 Hz to 160 kHz
HF cetaceans (true porpoises, Kogia, river dolphins, cephalorhynchid, Lagenorhynchus cruciger & L. australis)	202 dB_{peak} & 155 dB SEL_{cum}	173 dB SEL_{cum}	275 Hz to 160 kHz
Phocid pinnipeds (underwater) (true seals)	218 dB_{peak} & 185 dB SEL_{cum}	201 dB SEL_{cum}	50 Hz to 86 kHz
Otariid pinnipeds (underwater) (sea lions and fur seals)	232 dB_{peak} & 203 dB SEL_{cum}	219 dB SEL_{cum}	60 Hz to 39 kHz

NOAA has defined the threshold level for Level B harassment at 120 dB_{RMS} re 1 µPa for continuous noise and 160 $dB_{RMS90\%}$ re 1 µPa for impulse noise. Within this zone, the sound produced by the proposed HRG survey equipment may approach or exceed ambient sound levels (i.e., threshold of perception or zone of audibility); however, actual perceptibility will be dependent on the hearing thresholds of the species under consideration and the inherent masking effects of ambient sound levels. The Level B harassment threshold was not updated with the July 2016 technical guidance.

As discussed further in Section 5, evaluation of potential takes by incidental harassment of marine mammals resulting from the generation of underwater noise from operation of the sub-bottom profilers (GeoPulse Sub-bottom Profiler and Geo-Source sparker) during the proposed HRG Surveys will be evaluated under the criteria for PTS onset for impulsive noise as prescribed in the Technical Guidance for Assessing the Effects of Anthropogenic Sound on Marine Mammals (NMFS 2016; Table1-2) and NOAA's threshold level for Level B harassment of 160 $dB_{RMS90\%}$ re 1 µPa.

2 DATES, DURATION, AND SPECIFIC GEOGRAPHIC REGION

2.1 Dates and Duration

The HRG survey for the Lease Area and export cable route is anticipated to commence no earlier than August 1, 2018 and will last for up to 3 months. The segment of the HRG survey for the export cable route corridor is anticipated to last for approximately 2 months, and the wind turbine positions and inter-array cable area segments are anticipated to last for approximately 15 days each. This survey schedule is based on 24-hour operations and includes estimated weather down time.

2.2 Specific Geographic Region

The Applicant's survey activities will occur in the approximately 2,135-acre CVOW Lease Area, which is a portion of the Mid-Atlantic Wind Energy Area (WEA), and along a cable route corridor within the lower Chesapeake Bay as shown in Figure 1-1. The Applicant's survey activities will occur within both federal waters and state waters of Virginia.

3 SPECIES AND NUMBERS OF MARINE MAMMALS

The Mid-Atlantic Environmental Assessment (EA) (BOEM, 2012) reports 35 species of marine mammals (whales, dolphins, porpoise, and seals) that may occur off the Virginia coast that are protected by the MMPA, 6 of which are listed under the Endangered Species Act (ESA) and are known to be present, at least seasonally, in the Lease Area (See Table 3-1). A description of the status and distribution of these species are discussed in detail in Section 4.

Table 3-1 Marine Mammals Known to Occur in the Marine Waters in Coastal and Offshore Virginia

Common Name	Scientific Name	ESA and MMPA Status	Estimated Population	Stock
Oodntocetes (Toothed Whales)				
Phocoenidae				
Harbor Porpoise	*Phocoena phocoena*	MMPA	79,833	Gulf of Main/Bay of Fundy
Delphinidae				
White-Sided Dolphin	*Lagenorhynchus acutus*	MMPA	48,819	W. North Atlantic
Short-beaked Common Dolphin	*Delphinus delphis*	MMPA	70,184	W. North Atlantic
Bottlenose Dolphin	*Tursiops truncates*	MMPA	11,548	W. North Atlantic, Northern Migratory Coastal
Clymene Dolphin	*Stenella clymene*	MMPA	Unknown	W. North Atlantic
Pan-Tropical Spotted Dolphin	*Stenella attenuata*	MMPA	3,333	W. North Atlantic
Atlantic Spotted Dolphin	*Stenella frontalis*	MMPA	44,715	W. North Atlantic
Striped Dolphin	*Stenella coeruleoalba*	MMPA	54,807	W. North Atlantic
Risso's Dolphin	*Grampus griseus*	MMPA	18,250	W. North Atlantic
Spinner Dolphin	*Stenella longirostris*	MMPA	Unknown	W. North Atlantic
Killer Whale	*Orcinus orca*	Endangered-certain populations	Unknown	W. North Atlantic
False Killer Whale	*Pseudorca crassidens*	Strategic[c/]	442	W. North Atlantic
Melon-headed whale	*Peponocephala electra*	MMPA	Unknown	W. North Atlantic
Sperm Whale	*Physeter macrocephalus*	Endangered	2,288	North Atlantic
Dwarf Sperm Whale	*Kogia sima*	MMPA	3,785 [a/]	W. North Atlantic
Pygmy Sperm Whale	*Kogia breviceps*	MMPA	3,785 [a/]	W. North Atlantic
Long-finned Pilot Whale	*Globicephala melas*	MMPA	5,636	W. North Atlantic
Short-finned Pilot Whale	*Globicephala macrorhynchus*	MMPA	21,515	W. North Atlantic
Ziphiidae				
Blainville's Beaked Whale	*Mesoplodon densirostris*	MMPA	7,092 [b/]	W. North Atlantic
True's Beaked Whale	*Mesoplodon mirus*	MMPA	7,092 [b/]	W. North Atlantic
Gervais' Beaked Whale	*Mesoplodon europaeus*	MMPA	7,092 [b/]	W. North Atlantic
Cuvier's Beaked Whale	*Ziphius cavirostris*	MMPA	6,532	W. North Atlantic
Sowerby's Beaked Whale	*Mesoplodon bidens*	MMPA	7,092 [b/]	W. North Atlantic

Common Name	Scientific Name	ESA and MMPA Status	Estimated Population	Stock
Mysticetes (Baleen Whales)				
Balaenopteridae				
Humpback Whale	*Megaptera novaeangliae*	Strategic[c/]	823	Gulf of Maine
Fin Whale	*Balaenoptera physalus*	Endangered	1,618	W. North Atlantic
Sei Whale	*Balaenoptera borealis*	Endangered	357	Nova Scotia
Minke Whale	*Balaenoptera acutorostrata*	MMPA	2,591	Canadian East Coast
Blue Whale	*Balaenoptera musculus*	Endangered	Unknown	W. North Atlantic
Bryde's Whale	*Balaenoptera edeni*	MMPA	33	Gulf of Mexico
Balaenidae				
North Atlantic Right Whale	*Eubalaena glacialis*	Endangered	440[d/]	W. North Atlantic
Pinnipeds				
Phocidae				
Harbor Seal	*Phoca vitulina*	MMPA	75,834	W. North Atlantic
Gray Seal	*Halichoerus grypus*	MMPA	Unknown	W. North Atlantic
Harp Seal	*Pagophilus groenlandicus*	MMPA	Unknown	W. North Atlantic
Hooded Seal	*Cystophora cristata*	MMPA	Unknown	W. North Atlantic
Sirenia				
Trichechidae				
West Indian Manatee	*Trichechus manatus*	MMPA	Unknown	Florida

a/ This estimate may include both the dwarf and pygmy sperm whales.
b/ This estimate includes Gervais' and Blainville's beaked whales and undifferentiated Mesoplodon spp. beaked whales.
c/ A strategic stock is defined as any marine mammal stock: 1) for which the level of direct human-caused mortality exceeds the potential biological removal level; 2) which is declining and likely to be listed as threatened under the ESA; or 3) which is listed as threatened or endangered under the ESA or as depleted under the MMPA (http://www.ncseonline. org/nle/crsreports/biodiversity/biodv-11.cfm).
Sources: Waring et al. 2016; Waring et al. 2015; Waring et al 2013; Waring et al 2011; Warring et al 2010; RI SAMP 2011; Kenney and Vigness-Raposa 2009; NMFS 2012
d/ According to Pace *et. al.* 2017, the estimated population was 458 in 2015 with 17 momrtalities in 2017.

4 AFFECTED SPECIES STATUS AND DISTRIBUTION

As described in Section 3, there are up to 35 marine mammal species (whales, dolphins, porpoise, manatee, and seals) which are known to be present (some year-round, and some seasonally) in the Northwest Atlantic OCS region. NOAA uses Operating Area Density Estimates developed by the U.S. Navy (2007), supplemented by data from other sources, to update species Stock Assessment Reports. These reports suggest that marine mammal density in the Mid-Atlantic region is patchy and seasonally variable.

All 35 marine mammal species identified in Table 3-1 are protected by the MMPA and some are also listed under the ESA. The 6 ESA-listed marine mammal species known to be present year round or seasonally in the waters of the Mid-Atlantic are the sperm whale, right whale, fin whale, blue whale, sei whale, and the West Indian manatee. The humpback whale, which may occur year round, was recently delisted as an endangered species. All of these species are highly migratory and do not spend extended periods of time in a localized area. The offshore waters of Virginia, including the Project Area, are primarily used as a migration corridor for these species, particularly by right whales, during seasonal movements north or south between important feeding and breeding grounds (Knowlton et al. 2002; Firestone et al. 2008). There are no marine mammal sanctuaries in the waters off Virginia. While the fin, humpback, and right whales have the potential to occur within the Project Area, the sperm, blue, and sei whales are more pelagic and/or northern species, and their presence within the Project Area is unlikely (Waring et al. 2007; 2010; 2012; 2013). The West Indian manatee has been sighted in Virginia waters; however, such events are infrequent.

Because the potential for the sperm whale, blue whale, sei whale, and West Indian manatee to occur within the Project Area is unlikely, these species will not be described further in this analysis. In addition, while strandings data exists for harbor and gray seals along the Mid-Atlantic coast south of New Jersey, their preference for colder, northern waters during the survey period makes their presence in the Project Area unlikely during the summer and fall (Hayes et al 2017). Winter haul-out sites for harbor seals have been identified within the Chesapeake Bay region, however the seals are not present during summer and fall months during which survey activities are planned (Waring et al. 2016). In addition, coastal Virginia represents the southern extent of the habitat range for gray seals, with few stranding records reported for Virginia and sightings occurring only during winter months as far south as New Jersey (Waring et al. 2016). Therefore, these seal species will not be described further in this analysis.

The following subsections provide additional information on the biology, habitat use, abundance, distribution, and the existing threats to the non-endangered or threatened and endangered marine mammals that are both common in Virginia waters and have the likelihood of occurring, at least seasonally, in the Project Area. These species include the harbor porpoise, Atlantic white-sided dolphin, short-beaked common dolphin, bottlenose dolphin, Atlantic spotted dolphin, Risso's dolphin, and the long-finned pilot, short-finned pilot, minke, fin, humpback and right whales. In general, the range of the remaining non-ESA whale species listed in Table 3-1 is outside the CVOW Area; they are usually found in more pelagic shelf-break waters, have a preference for northern latitudes, or are so rarely sighted that their presence in the Project Area is unlikely. Because the potential presence of these species in the Project Area is considered extremely low, they are not further addressed in this analysis.

4.1 Toothed Whales (Odontonceti)

Harbor Porpoise (*Phocoena phocoena*) – Non-Strategic

The harbor porpoise is likely to occur in the waters of the Mid-Atlantic during winter months, as this species prefers cold temperate and subarctic waters (Waring et al. 2012; Waring et al. 2011). Porpoise generally move out of the Mid-Atlantic during spring, migrating to the Gulf of Maine. Harbor porpoise are the smallest North Atlantic cetacean, measuring at only 4.6 ft to 6.2 ft (1.4 m to 1.9 m), and feed primarily on pelagic schooling fish, bottom fish, squid and crustaceans (Bjorge and Tolley 2009; Reeves and Read 2003). Most strandings of harbor porpoise from 2005 to 2009 occurred in Massachusetts. During this time, a total of 450 harbor porpoise have stranded along the U.S. Atlantic coast (Waring et al. 2012). An unusual mortality event in 2005 involved the stranding of 38 animals along the North Carolina coast from January 1 to March 28 (Waring et al. 2012). The current population estimate for harbor porpoise for the Gulf of Maine/Bay of Fundy stock is 79,833 (Waring et al. 2016; Hayes et al. 2017). Its hearing is in the high-frequency range (Southall et al. 2007).

The most common threat to the harbor porpoise is incidental mortality from fishing activities, especially from bottom-set gillnets. It has been demonstrated that the porpoise echolocation system is capable of detecting net fibers, but they must not have the "system activated" or else they fail to recognize the nets (Reeves et al. 2002). Roughly 365 harbor porpoise are killed by human-related activities in U.S. and Canadian waters each year. In 1999, a Take Reduction Plan to reduce harbor porpoise bycatch in U.S. Atlantic gillnets was implemented. The ruling implements time and area closures, with some areas closed completely while others are closed to gillnet fishing unless the gear meets certain restrictions. In 2001, the

harbor porpoise was removed from the candidate species list for the ESA; a review of the biological status of the stock indicated that a classification of "Threatened" was not warranted (Waring et al. 2011). This species has been listed as "non-strategic" because average annual human-related mortality and injury does not exceed the potential biological removal (Waring et al. 2016; Hayes et al. 2017).

Bottlenose Dolphin (*Tursiops truncatus*) – Non-Strategic Offshore Migratory Stock; Non-Endangered Strategic Southern Coastal Migratory Stock

The bottlenose dolphin is a light- to slate-gray dolphin, roughly 8 to 12 ft (2.4 to 3.7 m) long with a short, stubby beak. Because this species occupies a wide variety of habitats, it is regarded as possibly the most adaptable cetacean (Reeves et al. 2002). It occurs in oceans and peripheral seas at both tropical and temperate latitudes. In North America, bottlenose dolphins are found in surface waters with temperatures ranging from 10 to 32°C (50 to 90°F). Its hearing is in the mid-frequency range (Southall et al. 2007).

The population of bottlenose dolphins in the North Atlantic consists of a complex mosaic of dolphin stocks (Waring et al. 2010). There are two distinct bottlenose dolphin morphotypes: migratory coastal and offshore. The migratory coastal morphotype resides in waters typically less than 65.6 ft (20 m) deep, along the inner continental shelf (within 7.5 km (4.6 miles) of shore), around islands, and is continuously distributed south of Long Island, New York into the Gulf of Mexico. This migratory coastal population is subdivided into 7 stocks based largely upon spatial distribution (Waring et al. 2016). Of these 7 coastal stocks, the Western North Atlantic migratory coastal stock is common in the coastal continental shelf waters off the North Carolina/Virginia border (Waring et al. 2016). These animals often move into or reside in bays, estuaries, the lower reaches of rivers, and coastal waters within the approximate 25 m depth isobath north of Cape Hatteras (Reeves et al. 2002; Waring et al. 2016). During winter, bottlenose dolphins are rarely observed north of the North Carolina/Virginia border (Waring et al. 2010).

Generally, the offshore migratory morphotype is found exclusively seaward of 34 km (21 miles) and in waters deeper than 34 m (111.5 feet). The offshore population extends along the entire continental shelf-break from Georges Bank to Florida during the spring and summer months, and has been observed in the Gulf of Maine during the late summer and fall. However, the range of the offshore morphotype south of Cape Hatteras has recently been found to overlap with that of the migratory coastal morphotype, sampled as close as 7.3 km (4.5 miles) from the shore in water depths of 13 m (42.7 feet) (Waring et al. 2016; Hayes et al. 2017). NMFS species stock assessment report estimates the population of Western North Atlantic offshore bottlenose dolphin stock at approximately 77,532 individuals and the Western North Atlantic migratory coastal stock at approximately 11,548 individuals (Waring et al. 2016; Hayes et al. 2017).

Bottlenose dolphins feed on a large variety of organisms, depending on their habitat. The coastal, shallow population tends to feed on benthic fish and invertebrates, while deepwater populations consume pelagic or mesopelagic fish such as croakers, sea trout, mackerel, mullet, and squid (Reeves et al. 2002). Bottlenose dolphins appear to be active both during the day and night. Their activities are influenced by the seasons, time of day, tidal state, and physiological factors such as reproductive seasonality (Wells and Scott 2002).

The biggest threat to the population is bycatch because they are frequently caught in fishing gear, gillnets, purse seines, and shrimp trawls (Waring et al. 2016). They have also been adversely impacted by pollution, habitat alteration, boat collisions, human disturbance, and are subject to bioaccumulation of toxins. Scientists have found a strong correlation between dolphins with elevated levels of PCBs and

illness, indicating certain pollutants may weaken their immune system (ACSonline 2004). Total U.S. fishery related mortality and serious injury for this stock is less than 10 percent of the calculated potential biological removal and, therefore, can be considered to be insignificant and approaching the zero mortality and serious injury rate. The common bottlenose dolphin in the western North Atlantic is not listed as threatened or endangered under the ESA, and the offshore stock is not considered strategic under the MMPA (Hayes et al. 2017). However, while the Southern Migratory Coastal Stock is not listed as threatened or endangered under the ESA, it is considered a strategic stock due to the depleted listing under the MMPA.

Short-Beaked Common Dolphin (*Delphinus delphis*) – Non-Strategic

The short-beaked dolphin is one of the most widely distributed cetaceans and occurs in temperate, tropical, and subtropical regions (Jefferson et al. 2008). Common dolphins feed on nutrient rich squids and small fish, including species that school in proximity to surface waters, and on mesopelagic species found near the surface at night (Waring et al. 2012; IUCN 2013). This species is found between Cape Hatteras and Georges Bank from mid-January to May. Between mid-summer and fall they migrate onto Georges Bank and the Scotian Shelf, and large aggregations occur on Georges Bank in fall (Waring et al. 2011). While this dolphin species can occupy a variety of habitats, short-beaked common dolphins occur in greatest abundance within a broad band off the northeast edge of Georges Bank in the fall (Selzer and Payne 1988). Although this species is widely distributed, sightings in the vicinity of Hudson Canyon and points south have occurred at low densities (Waring et al. 2006). The species is less common south of Cape Hatteras, although schools have been reported as far south as the Georgia/South Carolina border (Jefferson et al. 2008). According to the species stock report, the best population estimate for the common dolphin off the U.S. Atlantic coast is approximately 70,184 individuals (Hayes et al. 2017). Its hearing is in the mid-frequency range (Southall et al. 2007).

Short-beaked common dolphins can be found either along the 650- to 6,500-ft (200- to 2,000-m) isobaths over the continental shelf and in pelagic waters of the Atlantic and Pacific Oceans. They are present in the Western Atlantic from Newfoundland to Florida. The short-beaked common dolphin is especially common along shelf edges and in areas with sharp bottom relief such as seamounts and escarpments (Reeves et al. 2002). They show a strong affinity for areas with warm, saline surface waters. Off the coast of the eastern United States, they are particularly abundant in continental slope waters from Georges Bank southward to about 35 degrees north (Reeves et al. 2002) and usually inhabit tropical, subtropical, and warm-temperate waters (Waring et al. 2009; 2016).

The short-beaked common dolphin is also subject to bycatch. It has been caught in gillnets, pelagic trawls, and longline fishery activities. During 2008 to 2012, it was estimated that on average approximately 289 dolphins were killed each year by human activities (Waring et al. 2015). This number increased to 363 dolphins from 2009 to 2013 (Waring et al. 2016), and again from 2010 to 2014 where the number was estimated at 409 dolphins (Hayes et al. 2017). This species is also the most common dolphin species to be stranded along the southern New England Coast (Kenney and Vigness-Raposa 2009). Average annual fishery-related mortality and serious injury does not exceed the potential biological removal for this species; therefore, NMFS considers this species as "non-strategic" (Waring et al. 2009; 2010; 2015; 2016; Hayes et al. 2017).

White-Sided Dolphin (*Lagenorhynchus acutus*) – Non-Strategic

The Atlantic white-sided dolphin can be found in cold temperate to subpolar waters in the North Atlantic within deep OCS and slope waters (Jefferson et al. 2008). In the western North Atlantic, this species occurs from Labrador and southern Greenland to the coast of Virginia (Jefferson et al. 2008). During winter and spring, concentrations of Atlantic white-sided dolphins can be found in the Mid-Atlantic region, particularly in deeper waters along the continental slope (Waring et al. 2012). Atlantic white-sided dolphins range between 8.2 ft to 9.2 ft (2.5 and 2.8 m) in length, with females being approximately 20 cm shorter than males (Cipriano 2002). This species is highly social and is commonly seen feeding with fin whales. White-sided dolphins feed on a variety of small species, such as herring, hake, smelt, capelin, cod, and squid, with regional and seasonal changes in the species consumed (Cipriano 2002). Other prey species include mackerel, silver hake, and several other varieties of gadoids (Waring et al. 2012). Recent population estimates for Atlantic white-sided dolphins in the Western North Atlantic Ocean places this species at 48,819 individuals (Hayes et al. 2017). This species can be found off the coast of southern New England during all seasons of the year, but is usually most numerous in areas farther offshore at depth range of 330 ft (100 m) (Kenney and Vigness-Raposa 2009; Bulloch 1993; Reeves et al. 2002).

The biggest human-induced threat to the Atlantic white-sided dolphin is bycatch, because they are occasionally caught in fishing gillnets and trawling equipment. An estimated average of 328 dolphins each year were killed by fishery-related activities during 2003 to 2007 (Waring et al. 2010). From 2008 through 2012, an estimated annual average of 116 dolphins per year were killed (Waring et al. 2015), and from 2010 through 2014, the estimate decreased to 74 individuals annually (Hayes et al. 2017). Average annual fishery-related mortality and serious injury does not exceed the potential biological removal for this species; therefore, NMFS considers this species as "non-strategic" (Waring et al. 2011; 2015).

Atlantic Spotted Dolphin (*Stenella frontalis*) – Non-Strategic

There are two species of spotted dolphin in the Atlantic Ocean, the Atlantic spotted dolphin (*Stenella frontalis*) and the pantropical spotted dolphin (*S. attenuata*) (Perrin 1987). Where they co-occur, the two species can be difficult to differentiate (Waring et al. 2006). The larger form is associated with continental shelf habitat while the smaller form is more pelagic, preferring offshore waters and waters around oceanic islands (Perrin, 2009; 1994). In addition, two forms of the Atlantic spotted dolphin exist, one that is large and heavily spotted and the other is smaller in size with less spots (Waring et al. 2012). The Atlantic spotted dolphin prefers tropical to warm temperate waters along the continental shelf 10 to 200 meters (33 to 650 feet) deep to slope waters greater than 500 meters (1640 feet) deep. Their diet consists of a wide variety of fish and squid, as well as benthic invertebrates (Herzing 1997). According to the species stock report, the best population estimate for the Atlantic spotted dolphin is approximately 44,715 individuals (Hayes et al. 2017). Its hearing is in the mid-frequency range (Southall et al. 2007).

No fishing-related mortality of spotted dolphin was reported for 1998 through 2003 (Yeung, 1999; Yeung 2001; Garrison 2003; Garrison and Richards 2004). Average annual fishery-related mortality and serious injury does not exceed the potential biological removal for this species; therefore, NOAA Fisheries considers this species as "non-strategic" (Waring et al. 2006; 2015).

Risso's Dolphin (*Grampus griseus*) – Non-Strategic

Risso's dolphin is typically an offshore dolphin whose inshore appearance is uncommon (Reeves et al. 2002). Risso's dolphin prefers temperate to tropical waters along the continental shelf edge and can range from Cape Hatteras to Georges Bank from spring through fall, and throughout the Mid-Atlantic Bight out to oceanic waters during winter (Payne et al. 1984). Risso's dolphins are usually seen in groups of 12 to 40 individuals. Loose aggregations of 100 to 200, or even several thousand, are seen occasionally (Reeves et al. 2002). Sightings of this species from surveys were mostly in the continental shelf edge and continental slope areas (Waring et al. 2011). The diet for this species is comprised mostly of squid (Baird, 2009). According to the species stock report, the best population estimate for Risso's Dolphin is approximately 18,250 individuals (Hayes et al. 2017).

Risso's dolphin has been subject to bycatch. It has been caught in gillnets and pelagic longline fishery activities. From 2005 through 2009, the mean annual fishery-related mortality or serious injury was 18 dolphins (Waring et al. 2011). The total U.S. fishery mortality and serious injury rate for this stock is not less than 10% of the calculated PBR and, therefore cannot be considered to be insignificant and approaching zero; therefore, the status of Risso's dolphins is unknown but is not considered strategic (Hayes et al. 2017; Waring et al. 2016).

Long-Finned and Short-Finned Pilot Whale (*Globicephala melas* and *Globicephala macrorhynchus*) – Non-Endangered Strategic Western North Atlantic Stocks

The two species of pilot whales in the western Atlantic, the long-finned pilot whales and short-finned pilot whales, are difficult to differentiate. Therefore, both species are presented together, since much of the data is generalized for *Globicephala* species. Both species of pilot whale are more generally found along the edge of the continental shelf (a depth of 330 to 3,300 feet [100 to 1,000 meters]), choosing areas of high relief or submerged banks. In the western North Atlantic, long-finned pilot whales are pelagic, occurring in especially high densities in winter and spring over the continental slope, then moving inshore and onto the shelf in summer and autumn following squid and mackerel populations (Reeves et al. 2002). They frequently travel into the central and northern Georges Bank, Great South Channel, and Gulf of Maine areas during the summer and early fall (May to October) (NOAA 1993). Short-finned pilot whales prefer tropical, subtropical and warm temperate waters (Olson 2009). The short-finned pilot whale ranges from New Jersey south through Florida, the northern Gulf of Mexico, and the Caribbean (Waring et al. 2011). Populations for both of these species overlap between North Carolina and New Jersey (Waring et al. 2012; Waring et al. 2011). The best population estimate for long-finned pilot whales is 5,636 individuals, and for short-finned pilot whales it is 21,515 (Waring et al. 2016).

Pilot whales feed preferentially on squid but will eat fish (e.g., herring) and invertebrates (e.g., octopus, cuttlefish) if squid are not available. They also ingest shrimp (particularly younger whales) and various other fish species occasionally. These whales probably take most of their prey at depths of 600 to 1,650 feet (200 to 500 meters), although they can forage deeper if necessary (Reeves et al. 2002). Pilot whales are subject to bycatch in gillnet fishing, pelagic trawling, longline fishing, and purse seine fishing. Approximately 215 pilot whales were killed or seriously injured each year by human activities from 1997 to 2001. Strandings involving hundreds of individuals are not unusual and demonstrate that these large schools have a high degree of social cohesion (Reeves et al. 2002). While there is insufficient data to

determine population trends, both species are not listed as threatened or endangered under the ESA, but the Western North Atlantic stocks are strategic under the MMPA because the total U.S. fishery mortality and serious injury rate for these stocks exceed 10% of the calculated PBR (Hayes et al. 2017).

4.2 Baleen Whales (Mysticeti)

North Atlantic Right Whale (*Eubalaena glacialis*) – Endangered

The North Atlantic right whale was listed as a federal endangered species in 1970. The North Atlantic right whale has seen a nominal 2 percent recovery rate since it was listed as a protected species (NOAA 2015a). Right whales are considered grazers as they swim slowly with their mouths open. They are the slowest swimming whales and can only reach speeds up to 10 miles (mi) (16 km) per hour. They can dive at least 1,000 ft (300 m) and stay submerged for typically 10 to 15 minutes, feeding on their prey below the surface (ACSonline 2004). Right whales' hearing is in the low-frequency range (Southall et al. 2007).

The right whale is a strongly migratory species that moves annually between high-latitude feeding grounds and low-latitude calving and breeding grounds. The present range of the western North Atlantic right whale population extends from the southeastern United States, which is utilized for wintering and calving, to summer feeding and nursery grounds between New England and the Bay of Fundy and the Gulf of St. Lawrence (Kenney 2002; Waring et al. 2011). The winter distribution of North Atlantic right whales is largely unknown, although offshore surveys have reported 1 to 13 detections annually in northeastern Florida and southeastern Georgia (Waring et al. 2013). A few events of right whale calving have been documented from shallow coastal areas and bays (Kenney 2002).

North Atlantic right whales may be found in feeding grounds within New England waters between February and May, with peak abundance in late March (NMFS 2005). Mid-Atlantic waters likely are primarily used as a migration corridor during these seasonal movements north or south between important feeding and breeding grounds (Knowlton et al. 2002; Firestone et al. 2008).

The North Atlantic right whale was the first species targeted during commercial whaling operations and was the first species to be greatly depleted as a result of whaling operations (Kenney 2002). North Atlantic right whales were hunted in southern New England until the early twentieth century. Shore-based whaling in Long Island involved catches of right whales year-round, with peak catches in spring during the northbound migration from calving grounds off the southeastern United States to feeding grounds in the Gulf of Maine (Kenney and Vigness-Raposa 2009). Abundance estimates for the North Atlantic right whale population vary. From the 2003 United States Atlantic and Gulf of Mexico Marine Mammal Stock Assessments, there were only 291 North Atlantic right whales in existence, which is less than what was reported in the Northern Right Whale Recovery Plan written in 1991 (NMFS 1991a; Waring et al. 2004). This is a tremendous difference from pre-exploitation numbers, which are thought to be around 1,000 individuals. When the right whale was finally protected in the 1930s, it is believed that the North Atlantic right whale population was roughly 100 individuals (Waring et al. 2004). In 2015, the Western North Atlantic population size was estimated to be at least 476 individuals (Waring et al. 2016). That population size estimate decreased to 440 individuals in 2017 (Hayes et al. 2017). Additional information provided by Pace et al. (2017), confirms that the probability that the North Atlantic right whale population has declined since 2010 is 99.99 percent. Data indicates that the number of adult females dropped from 200 in 2010 down to 186 in 2015 while males dropped from 283 to 272 in the same timeframe. Also cause for concern

is the confirmed mortality of 17 individuals in 2017 alone (Pace et al. 2017).

Contemporary anthropogenic threats to right whale populations include fishery entanglements and vessel strikes, although habitat loss, pollution, anthropogenic noise, and intense commercial fishing may also negatively impact their populations (Kenney 2002). Ship strikes of individuals can impact North Atlantic right whales on a population level due to the intrinsically small remnant population that persists in the North Atlantic (Laist et al. 2001). Between 2002 and 2006, a study of marine mammal stranding and human-induced interactions reported that right whales in the western Atlantic were subject to the highest proportion of entanglements (25 of 145 confirmed events) and ship strikes (16 of 43 confirmed occurrences) of any marine mammal studied (Glass et al. 2008). Bycatch of North Atlantic right whale has also been reported in pelagic drift gillnet operations by the Northeast Fisheries Observer Program, however, no mortalities have been reported (Glass et al. 2008). From 2010 through 2014, the minimum rate of annual human-caused mortality and serious injury to this species from fishing entanglements averaged 5.66 per year, while ship strikes averaged 1.01 whales per year (Hayes et al. 2017). Environmental fluctuations and anthropogenic disturbance may be contributing to a decline in overall health of individual North Atlantic right whales that has been occurring for the last 3 decades (Rolland et al. 2016). The NOAA marine mammal stock assessment for 2015 reports that the low annual reproductive rate of right whales, coupled with small population size, suggests anthropogenic mortality may have a greater impact on population growth rates for the species than for other whales and that any single mortality or serious injury can be considered significant (Waring et al. 2016).

Most ship strikes are fatal to the North Atlantic right whales (Jensen and Silber 2004). Right whales have difficulty maneuvering around boats and spend most of their time at the surface, feeding, resting, mating, and nursing, increasing their vulnerability to collisions. Mariners should assume that North Atlantic right whales will not move out of their way nor will they be easy to detect from the bow of a ship for they are dark in color and maintain a low profile while swimming (World Wildlife Fund 2005). To address potential for ship strike, NMFS designated the nearshore waters of the Mid-Atlantic Bight as the Mid-Atlantic U.S. Seasonal Management Area (SMA) for right whales in December 2008. NMFS requires that all vessels 65 ft (19.8 m) or longer must travel at 10 knots or less within the right whale SMA from November 1 through April 30 when right whales are most likely to pass through these waters (NOAA 2010). The most recent stock assessment report noted that studies by van der Hoop et al. (2015) have concluded large whale vessel strike mortalities decreased inside active SMAs but have increased outside inactive SMAs. The CVOW Wind Turbine Positions, Inter-Array Cable Area, and Export Cable Route Corridor are located within the right whale Mid-Atlantic SMA at the mouth of the Chesapeake Bay.

Right whales have been observed in or near Virginia waters from October through December, as well as in February and March, which coincides with the migratory time frame for this species (Knowlton et al. 2002). Based on the migratory pattern and the establishment of an SMA around approaches to Chesapeake Bay, right whales have the potential to occur in the Project Area, particularly during peak migration times, and overall likelihood of occurrence in the Project Area is rated as high.

Humpback Whale (*Megaptera novaeangliae*) – Strategic/Non-Endangered for West Indies Distinct Population Segment

The humpback whale was listed as endangered in 1970 due to population decrease resulting from overharvesting. Humpback whales were hunted as early as the seventeenth century, with most whaling operations having occurred in the nineteenth century (Kenney and Vigness-Raposa 2009). By 1932, commercial hunting within the North Atlantic may have reduced the humpback whale population to as few as 700 individuals (Breiwick et al. 1983). North Atlantic humpback whaling ended worldwide in 1966 (NatureServe 2013). The humpback whale population within the North Atlantic has been estimated to include approximately 11,570 individuals (Waring et al. 2015; 2016). Through photographic population estimates, humpback whales within the Gulf of Maine (the only region where these whales summer in the United States) have been estimated to consist of 600 individuals in 1979 (NMFS 1991b). According to the latest species stock assessment report, the best estimate of abundance for the Gulf of Maine stock of humpback whales is 823 individuals (Hayes et al. 2017).

Humpback whales feed on small prey that is often found in large concentrations, including krill and fish such as herring and sand lance (Waring et al. 2013; Kenney and Vigness-Raposa 2009). A majority of female humpback whales migrate from the North Atlantic to the Caribbean in winter, where calves are born between January and March (Blaylock et al. 1995). Not all humpback whales migrate to the Caribbean during winter, and numbers of this species are sighted in mid- to high-latitude areas during winter (Clapham et al. 1993; Swingle et al. 1993). The Mid-Atlantic area may also serve as important habitat for juvenile humpback whales, evidenced by increased levels of juvenile strandings along the Virginia and North Carolina coasts (Wiley et al. 1995).

Contemporary human threats to humpback whales include fishery entanglements and vessel strikes. Glass et al. (2008) reported that between 2002 and 2006, humpback whales belonging to the Gulf of Maine population were involved in 77 confirmed entanglements with fishery equipment and 9 confirmed ship strikes. Humpback whales that were entangled exhibited the highest number of serious injury events of the six species of whale studied by Glass et al. (2008). A whale mortality and serious injury study conducted by Nelson et al. (2007) reported that the minimum annual rate of anthropogenic mortality and serious injury to humpback whales occupying the Gulf of Maine was 4.2 individuals per year. During this study period, humpback whales were involved in 70 reported entanglements and 12 vessel strikes, and were the most common dead species reported. NOAA Fisheries records for 2006 through 2010 indicate 10 reports of mortalities as a result of collision with a vessel, and 29 serious injuries and mortalities attributed to entanglement (Waring et al. 2013).

Humpback whales exhibit consistent fidelity to feeding areas within the northern hemisphere (Stevick et al. 2006), effectively creating six subpopulations that feed in six different areas during spring, summer, and fall. These populations can be found in the Gulf of Maine, the Gulf of St. Lawrence, Newfoundland/Labrador, western Greenland, Iceland, and Norway (Waring et al. 2013). Humpback whales migrate from these feeding areas to the West Indies (including the Antilles, the Dominican Republic, the Virgin Islands and Puerto Rico) where they mate and calve their young (NMFS 1991; Waring et al. 2013). While migrating, humpback whales utilize the Mid-Atlantic as a migration pathway between calving/mating grounds to the south and feeding grounds in the north (Waring et al. 2013). Humpbacks typically occur within the Mid-Atlantic region during fall, winter, and spring months (Waring et al. 2012).

Therefore, humpback whales have the potential to occur in the Project Area during these seasons, and overall likelihood of occurrence in the Project Area is rated as high.

Fin Whale (*Balaenoptera physalus*) – Endangered

The fin whale was listed as federally endangered in 1970. The best abundance estimate for fin whales in the western North Atlantic is 1,618 individuals (Waring et al. 2016). Present threats to fin whales are similar to those that threaten other whale species, namely fishery entanglements and vessel strikes. Fin whales seem less likely to become entangled than other whale species. Glass et al. (2008) reported that between 2002 and 2006, fin whales belonging to the Gulf of Maine population were involved in only eight confirmed entanglements with fishery equipment. Furthermore, Nelson et al. (2007) reported that fin whales exhibited a low proportion of entanglements (eight reported events) during their 2001 to 2005 study along the western Atlantic. NOAA Fisheries data indicate two records with substantial evidence of fishery interactions causing mortality, with an additional two interactions resulting in serious injury from 2005 through 2009 (Waring et al. 2011). On the other hand, vessel strikes may be a more serious threat to fin whales. Glass et al. (2008) reported eight vessel strikes, while Nelson et al. (2007) reported ten strikes. NOAA Fisheries data indicate that nine fin whales were confirmed killed by collision from 2005 through 2009 (Waring et al. 2011). A study compiling whale/vessel strike reports from historical accounts, recent whale strandings, and anecdotal records by Laist et al. (2001) reported that of the 11 great whale species studied, fin whales were involved in collisions most frequently (31 in the United States and 16 in France). From 2005 to 2009, the minimum annual rate of mortality for the North Atlantic stock from anthropogenic causes was approximately 2.6 per year (Waring et al. 2011) while from 2009 to 2013, this number increased to 3.55 (Waring et al. 2016), and from 2010 to 2014, this number increased to 3.8 per year (Hayes et al. 2017). Increase in ambient noise has also impacted fin whales, for whales in the Mediterranean have demonstrated at least two different avoidance strategies after being disturbed by tracking vessels (Jahoda et al. 2003).

Fin whales are the second largest living whale species on the planet (Kenney and Vigness-Raposa 2009). The range of fin whales in the North Atlantic extends from the Gulf of Mexico, Caribbean Sea, and Mediterranean Sea in the south to Greenland, Iceland, and Norway in the north (Jonsgård 1966; Gambell 1985). They are the most commonly sighted large whales in continental shelf waters from the Mid-Atlantic coast of the United States to Nova Scotia, principally from Cape Hatteras northward (Sergeant 1977; Sutcliffe and Brodie 1977; CETAP 1982; Hain et al. 1992; Waring et al. 2011). Fin whales, much like humpback whales, seem to exhibit habitat fidelity to feeding areas (Waring et al. 2011; Kenney and Vigness-Raposa 2009). While fin whales typically feed in the Gulf of Maine and the waters surrounding New England, mating and calving (and general wintering) areas are largely unknown (Waring et al. 2011). Strandings data indicate that calving may take place in the Mid-Atlantic region during October to January for this species (Hain et al. 1992).

Fin whales are present in the Mid-Atlantic region during all four seasons, although sightings data indicate that they are more prevalent during winter, spring, and summer (Waring et al 2012). While fall is the season of lowest overall abundance off Virginia, they do not depart the area entirely. Consequently, the likelihood of occurrence in the Project Area is rated as high.

Minke Whale (Balaenoptera acutorostrata) – Non-Strategic

Minke whales are the smallest and are among the most widely distributed of all the baleen whales. They occur in the North Atlantic and North Pacific, from tropical to polar waters. Scientists currently recognize two subspecies of the so-called "common" minke whale: the North Atlantic minke and the North Pacific minke. Generally, they inhabit warmer waters during winter and travel north to colder regions in summer, with some animals migrating as far as the ice edge. They are frequently observed in coastal or shelf waters. Minke whales off the eastern coast of the United States are considered to be part of the Canadian East Coast stock. In the 2015 stock assessment, the estimate for minke whales in the Canadian East Coast stock was 20,741 (Waring et al. 2016). This population estimate substantially decreased to 2,591 individuals in the most recent stock assessment because estimates older than eight years were excluded from the newest estimate (Hayes et al., 2017). This new estimate should not be interpreted as a decline in abundance of this stock, as previous estimates are not directly comparable (Hayes et al., 2017). Minke whales have been observed south of New England during all four seasons; however, widespread abundance is highest in spring through fall (Waring et al. 2016). Their hearing is in the low-frequency range (Southall et al. 2007).

As is typical of the baleen whales, minke whales are usually seen either alone or in small groups, although large aggregations sometimes occur in feeding areas (Reeves et al. 2002). Minke populations are often segregated by sex, age, or reproductive condition. Known for their curiosity, minkes often approach boats. They feed on schooling fish (e.g., herring, sand eel, capelin, cod, pollock, and mackerel), invertebrates (squid and copepods), and euphausiids. Minke whales basically feed below the surface of the water, and calves are usually not seen in adult feeding areas.

Minke whales are affected by ship strikes and bycatch from gillnet and purse seine fisheries. From 2008 to 2012, the minimum annual rate of mortality for the North Atlantic stock from anthropogenic causes was approximately 9.9 per year (Waring et al. 2015), while from 2010 to 2014 this decreased to 8.25 per year (Hayes et al. 2017). In addition, hunting for Minke whales continues today, by Norway in the northeastern North Atlantic and by Japan in the North Pacific and Antarctic (Reeves et al. 2002). International trade in the species is currently banned. Average annual fishery-related mortality and serious injury does not exceed the potential biological removal for this species; therefore, NMFS considers this species as "non-strategic" (Waring et al. 2010; 2011; 2015; 2016; Hayes et al. 2017).

5 TYPE OF INCIDENTAL TAKING REQUESTED

The Applicant is requesting the authorization for potential non-lethal "taking" of small numbers of marine mammals to allow for incidental harassment resulting from the UXO investigation surveys. The request is based upon projected HRG survey activities during the anticipated survey schedule as stated in Section 2.1.

The noise impacts of HRG survey equipment were evaluated under the criteria prescribed for PTS Onset in the Technical Guidance for Assessing the Effects of Anthropogenic Sound on Marine Mammals (NMFS 2016) to determine the potential for take by Level A harassment. To determine the potential for Level B harassment, the take criteria for impulsive noise (160 $dB_{RMS90\%}$ re 1 µPa) was applied. The peak, root mean square (RMS), and sound exposure levels (SEL) for HRG equipment that were applied in subsequent calculations have been referenced from the pending application for HRG Survey Activity for the Ocean Wind Project (Ocean Wind LLC, 2017) and are presented in Table 5-1 for the field verified HRG equipment. The linear regression method results in some variability in source terms as compared to

information provided by the equipment manufacturer shown in Table 1-1. Additional metrics not included in the manufacturers' specification but required to complete the full hydroacoustic analysis were also derived directly from the HRG field verification measurement results.

Per guidance provided by NMFS (Personal Communication, April 11, 2017) the source levels as defined in Table 5-1 were used to determine distances to the criteria thresholds using the NMFS screening level methodology (NMFS 2016). It is worth noting that the NMFS calculation methodology does not consider the beamwidth or directivity of HRG sound sources, or the variable characteristics of the ocean environment, both of which can further reduce horizontal propagation distances over very short propagation distances close to the source. It also is important to note that these specialized effects were also ignored during the development of the HRG apparent source terms from field verification measurement results, but overall effects to reported distance to thresholds are expected to be negligible and results are consistent at distances where the field verification measurements were actually completed.

Table 5-1 Field Verified HRG Survey Data Acquisition Equipment Apparent Source Levels

HRG Survey Equipment	Apparent Source Levels		
	dB_{Peak}	dB_{RMS}	SEL
Sonardyne Ranger 2 USBL	206	117	160
Klein 300H Sidescan Sonar*	N/A	N/A	N/A
GeoPulse Sub-bottom Profiler	197	173	161
Geo-Source 800	208	186	183
SeaBat 7125 Multibeam Sonar*	N/A	N/A	N/A
*Note: Operating frequencies are above all relevant marine mammal hearing thresholds and outside standard underwater test equipment measurement ranges.			

The Innomar Medium 100 sub-bottom profiler has not yet been field verified. Therefore, a modeling analysis was completed using a Gaussian beam tracing method as implemented in BELLHOP. This calculation method is widely used by noise engineers and marine biologists due to adaptabilities to describe complex acoustic propagation in the underwater environment by taking into account the geoacoustic properties of the sea bottom conditions, vertical sound speed profile in the water column, and range-dependent bathymetry.

The BELLHOP model allows the user to account for the source directivity, which is specified as a function of both azimuthal angle and depression angle. Directionality is generally measured in decibels relative to the maximum radiation level along the central axis perpendicular to the transducer surface. For different HRG transducers, the beamwidth varies from 180° (almost omnidirectional) to a few degrees. This directional capability increases with increasing operating frequency. In the case of the Innomar Medium-100 sub bottom profiler, a very narrow beamwidth of 1^0 and main beam axis direction downwarnd were described numerically for the primary frequency of 100 kHz, as shown in Figure 5-1.

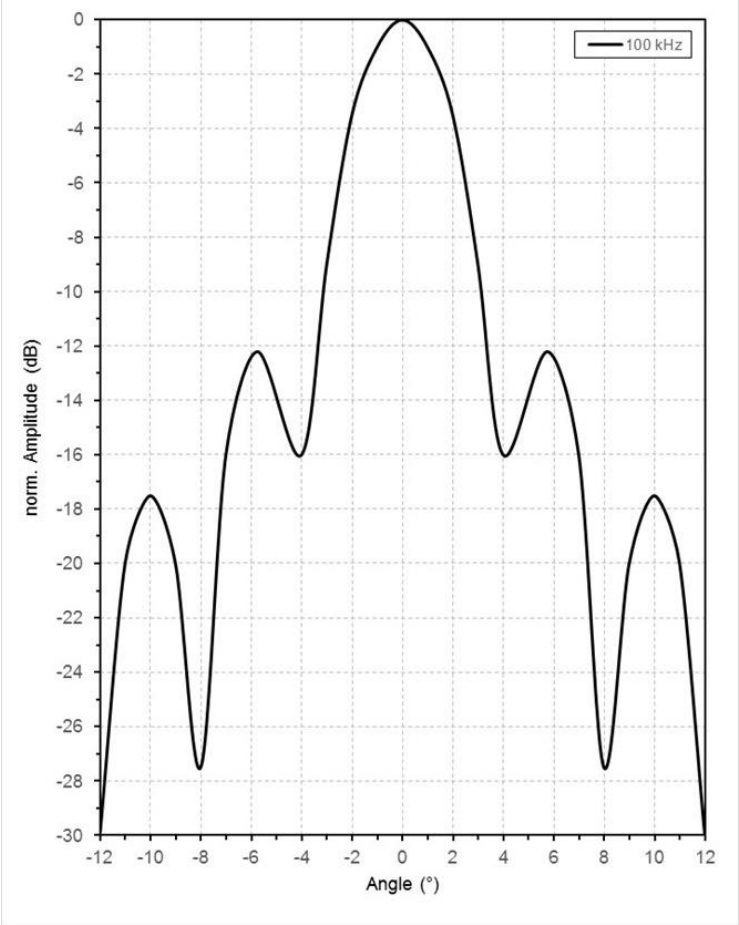

Figure 5-1 Innomar SES-2000 SBP Normalized Beampattern

The resulting modeled directional sound levels (SLs) were used as the input for the acoustic propagation model. The direcitivty plot demonstrates how the immediate water volume insonified by the Innomar Medium 100 sub-bottom profiler is rather small due to the narrow sound beamwidth produced. Outside the immediate direct beamwidth pattern, the emitted sound waves will interact with the seafloor and water surface. These losses are defined by the ratio between incident and reflected sound energy which is dependent on the acoustic impedances of the seafloor. Also, the maximum duty cycle of 1.4 percent was provided, which accounts for the pulse shape and duration were used for cumulative exposure calculations. The resulting distance to thresholds were confirmed as appropriate during direct consultation with the equipment manufacturer (personal communication January 23, 2018)[1].

The lateral distances to the PTS onset and Level B harassment thresholds are defined in Table 5-2 and Table 5-3. The lateral distance to the Level B harassment threshold to the GeoPulse sub-bottom profiler, Geo-Source 800 sparker, and Innomar Medium 100 sub-bottom profiler are less than 5 m, 20 m, and 100 m,

[1] Personal communication with Dr.-Ing. Jens Wunderlich, Manager of Research and Development, Innomar Technologie GmbH

respectively. The Level B threshold considers instantaneous sound pressure levels at a given receiver location. Being expressed in RMS units, the criteria accounts for not only the energy of the signal, but also the length of the pulse. The NOAA Fisheries acoustic guidelines were purposely developed to be protective of all marine species from high sound pressure levels. These levels are calculated from unweighted acoustic signals, so they do not account for the different hearing abilities of animals at different frequencies.

It is expected that environmental conditions are similar for the CVOW Area in comparison to what exists within the Ocean Wind Offshore Wind Farm located off the coast of New Jersey, and that noise profiles for the data acquisition equipment listed in Table 1-1 will not differ from the results previously reported and field verified.. As evidenced in and supported by the 2017 field verification report for the Ocean Wind Offshore Wind Farm submitted to BOEM in September 2017 (Ocean Wind LLC, 2017), and associated modeling analyses completed by Tetra Tech, Level A harassment will only potentially occur close to the HRG source (Table 5-2), except in the case of HF cetaceans (e.g. harbor porpoise), where the Innomar Medium 100 sub-bottom profiler reaches a distance of up to 164.0 ft (50 m). The Innomar Medium 100 sub-bottom profiler, with a manufacturer stated source level of 243 dB_{rms} and 250_{Peak} dB at full power, and mean primary frequency of 85 kHz, is more perceptible to HF cetaceans (e.g. harbor porpoise) than to other cetacean species. Additionally, survey activities could result in temporary Level B harassment of marine mammals. Furthermore, while the Level A harassment zone for delphinoid cetaceans is shown to be within 16.4 ft (5 m) of the noise sources, these species have shown a proclivity to voluntarily approach HRG survey equipment while in active use. Due to directivity effects of HRG sources with the majority of the sound energy directed towards the sea floor, it is likely that the actual lateral distance to the Level A threshold is even closer to the noise source than presented and thus the onset of PTS for these species is unlikely. The Applicant proposes a Level A exclusion zone at the linear distance fo 50 m from the sound source to prevent harassment of harbor porpoise (see Seciton 11.3). However, considering the numbers of delphinoid cetaceans expected in the survey area, and their apparent propensity to voluntarily approach vessels which may be operating HRG noise sources, Level A take has been calculated and requested to allow continuous survey activity. Therefore, the Applicant is requesting the authorization for the incidental take by Level A harassment of small numbers of delphinoid cetaceans, as well as Level B harassment of small numbers of other marine mammals in the waters of the CVOW Survey Area, pursuant to Section 101 (a) (5) of the MMPA and in accordance with 50 CFR § 216 Subpart I, in support of the Applicant's survey activities as further detailed in Section 6.

Table 5-2 Distances to Regulatory Thresholds – Level A

Marine Mammal Group	PTS Onset	Lateral Distance (m)
GeoPulse Subbottom Profiler		
LF cetaceans	219 dBpeak 183 dB SEL_{cum}	--- < 1
MF cetaceans	230 dBpeak 185 dB SEL_{cum}	--- ---
HF cetaceans	202 dBpeak 155 dB SEL_{cum}	< 1 16
Phocid pinnipeds	218 dBpeak 185 dB SEL_{cum}	--- < 1
Geo-Source 800 Sparker		
LF cetaceans	219 dBpeak 183 dB SEL_{cum}	--- 5
MF cetaceans	230 dBpeak 185 dB SEL_{cum}	--- < 1
HF cetaceans	202 dBpeak 155 dB SEL_{cum}	< 1 24
Phocid pinnipeds	218 dBpeak 185 dB SEL_{cum}	--- 3
Innomar Medium 100 Sub-bottom Profiler		
LF cetaceans	219 dBpeak 183 dB SEL_{cum}	< 1 N/A
MF cetaceans	230 dBpeak 185 dB SEL_{cum}	< 1 ---
HF cetaceans	202 dBpeak 155 dB SEL_{cum}	< 5 < 50
Phocid pinnipeds	218 dBpeak 185 dB SEL_{cum}	< 1 N/A
Note: The peak SPL and Level B criterion is un-weighted (i.e., flat weighted), whereas the cumulative SEL criterion is M-weighted for the given marine mammal functional hearing group. --- indicates not expected to be measurable to stated regulatory threshold at any appreciable distance. N/A indicates not applicable as the HRG sound source is outside the effective marine mammal hearing range.		

Table 5-3 Distances to Regulatory Thresholds – Level B

PTS Onset	Lateral Distance (m)
GeoPulse Subbottom Profiler	
160 $dB_{RMS90\%}$	< 5
Geo-Source 800 Sparker	
160 $dB_{RMS90\%}$	< 20
Innomar Medium 100 Sub-bottom Profiler	
160 $dB_{RMS90\%}$	< 100

6 TAKE ESTIMATES FOR MARINE MAMMALS

The Applicant seeks authorization for potential "taking" of small numbers of marine mammals due to incidental harassment under the jurisdiction of NMFS in the proposed region of activity. Anticipated impacts to marine mammals from the proposed survey activities will be associated with noise propagation from the use of specific HRG survey equipment. It should be noted that the estimates of exposure for marine mammals as presented in this section are conservative.

6.1 Basis for Estimating Numbers of Marine Mammals that Might be "Taken by Harassment"

Most marine animals can perceive underwater sounds over a broad range of frequencies from about 10Hz to more than 10,000 Hz (10 kHz). Many of the dolphins and porpoises use even higher frequency sound for echolocation and perceive these high frequency sounds with high acuity. Marine mammals respond to low-frequency sounds with broadband intensities of more than about 120 dB re 1µPa, or about 10 to 20 dB above natural ambient noise at the same frequencies (Richardson et al. 1991). The functional hearing ranges for the marine mammals in this evaluation have a potential for acoustic take in the Survey Area at the time of the proposed surveys (see Table 1-2 for hearing ranges by functional hearing groups).

Sound is important to marine mammals for communication, individual recognition, predator avoidance, prey capture, orientation, navigation, mate selection, and mother-offspring bonding. Potential effects of anthropogenic sounds to marine mammals can include physical injury (e.g., temporary or permanent loss of hearing sensitivity), behavioral modification (e.g., changes in foraging or habitat-use patterns), and masking (the prevention of marine mammals from hearing important sounds).

The survey activities that have the potential to cause harassment as defined by the MMPA include the noise produced by the 800 kJ Geo-Source (160 dB_{rms} re 1 µPa), GeoPulse Sub-bottom Profiler, and the Innomar Medium 100 sub-bottom profiler. As stated previously, previous hydroacoustic modeling assessments of the representative HRG survey equipment have been conducted to better understand both the level and extent of underwater noise generated by the marine site characterization survey activities and their potential to impact marine species (Ocean Wind LLC, 2017).

The basis for the incidental take estimate is the number of marine mammals that would be exposed to sound levels in excess of Level A harassment criteria (155 dB SEL_{cum}) and Level B harassment criteria (160 dB_{RMS} re 1 µPa). Typically, this is determined by multiplying the zone of influence (ZOI) out to the respective harassment criteria isopleth by local marine mammal density estimates, and then correcting for seasonal use by marine mammals, seasonal duration of project-specific noise-generating activities, and estimated duration of individual activities when the maximum noise-generating activities are intermittent or occasional. In the absence of any part of this information, it becomes prudent to take a conservative approach to ensure the potential number of takes is not greatly underestimated.

The estimated distance of the daily vessel trackline was determined using the estimated average speed of the vessel, radial distance of each corresponding criteria isopleth, and the 24 hour operational period within each of the survey segments. All noise producing survey equipment are assumed to be operated concurrently. The daily vessel track line distances of approximately 110.5 mi (177.8 km) was buffered by the corresponding radial distances of 328.1 ft (100 m) to the 160 dBRMS re 1 µPa Level B isopleth, and Level A harassment criteria (155 dB SEL_{cum}) distance of 16.4 ft (5 m) for delphinoid cetaceans , to calculate estimates of incidental take by HRG survey equipment as depicted in Table 6-1. This buffer also included the corresponding radial area of the circle created by each isopleth to represent the beginning and end of the track line. As stated previously, the Applicant proposes a Level A exclusion zone at the Level A harassment criteria (155 dB SEL_{cum}) distance of 164.0 ft (50 m) for harbor porpoise to prevent harassment of this species (see Seciton 11.3).

Table 6-1 HRG Survey Segment ZOIs

Survey Segment	Number of Active Survey Days	Estimated distances per day (km)	Calculated ZOI per day (km²)	
			Level A Dolphins	Level B
Wind Turbine Positions	**15**	**177.8**	**1.78**	**35.59**
Inter-Array Cable Area	**15**	**177.8**	**1.78**	**35.59**
Export Cable Route Corridor	**60**	**177.8**	**1.78**	**35.59**

6.2 Estimate of Numbers of Marine Mammals that Might be "Taken by Harassment"

Estimates of potential take by incidental harassment are computed according to the following formula as provided by NOAA (Personal Communication, November 24, 2015):

$$Estimated\ Take = D \times ZOI \times (d)$$

Where:

D = average highest species density (number per m^2)

ZOI = maximum ensonified area to MMPA thresholds for impulsive noise (160 $dB_{RMS90\%}$ re 1 µPa)

d = number of days

Per new NOAA guidance for mobile sound sources, the ZOI was calculated according to the following formula (Personal Communication, November 24, 2015):

ZOI = maximum ensonified area around the sound source X the line statute miles traveled over a 24-hr period.

It should be noted, however, that this calculation will result in an over conservative ZOI as it assumes that once an area along a survey trackline is ensonified by the sound source that the area will remain ensonified at a level that will result in acoustic take (160 $dB_{RMS90\%}$ re 1 µPa) throughout the entire 24-hr period. As evidenced and summarized in Section 1.2, the only time survey activities could result in take by Level A or Level B acoustic harassment is if a marine mammal were to enter into the respective ensonified area associated with the HRG survey equipment being operated. In addition, Level A take is likely an overestimate considering the temporal component within the NMFS calculation methodology which anticipates short potential exposures due to the mobility of the sound source and movement of individual animals.

The data used as the basis for estimating cetacean density ("D") for the Survey segments are sightings per unit effort (SPUE) derived by Duke University (Roberts et al. 2016). For pinnipeds, the only available comprehensive data for seal abundance continues to be the Northeast Navy Operations Area (OPAREA) Density Estimates (DoN 2007). SPUE (or, the relative abundance of species) is derived by using a measure of survey effort and number of individual cetaceans sighted. SPUE allows for comparison between discrete units of time (i.e. seasons) and space within a project area (Shoop and Kenney, 1992). The Duke University (Roberts et al. 2016) cetacean density data represent models derived from aggregating line-transect surveys conducted over 23 years by 5 institutions (NOAA NMFS Northeast Fisheries Science Center [NEFSC], New Jersey Department of Environmental Protection [NJDEP], NOAA NMFS Southeast Fisheries Science Center [SEFSC], University of North Carolina Wilmington [UNCW], and Virginia Aquarium & Marine

Science Center [VAMSC]), the results of which are freely available online at the Ocean Biogeographic Information System Spatial Ecological Analysis of Megavertebrate Populations (OBIS-SEAMAP) repository. Monthly density values within the survey area were averaged by season to provide seasonal density estimates.

Due to the spatial distribution and transient nature of marine mammal species identified; the relatively short duration of the activities and the time of year the Applicant proposes to conduct UXO investigation survey activities; and the implementation of the mitigation measures as described in Section 11, these activities are not likely to result in serious injury or death of marine mammals. In addition, the take estimates as provided in Section 6.2.1 are not only based on an overly conservative ZOI but they do not take into consideration mitigation measures and therefore are likely a significant overestimate of the actual potential for take by Level B acoustic harassment.

6.2.1 Estimate of Potential Project HRG Survey Takes by Harassment

The parameters in Table 6-1 were used to estimate the potential take by incidental harassment for each segment of the HRG survey. Density data from Roberts et al. (2016) were mapped within the boundary of the Survey Area for each segment (Figure 1-1) using geographic information systems. For wind turbine positions and the inter-array cable route area, species densities, as reported by Roberts et al. (2016) within the maximum survey area for these segments, were averaged by season (summer: June, July, and August; fall: September, October and November). This timeperiod was used based on the proposed HRG survey schedule (commencing no earlier than August 1, 2018), and acknowledging potential survey activity overlap into fall months. Potential take calculations were then based on the maximum average seasonal species density (between summer and fall) within the maximum survey area. Similarly, for the export cable route area, species densities were averaged by season (summer: June, July, and August; fall: September, October and November) to determine average seasonal density. Potential take calculations were then based on the maximum average seasonal species density (between summer and fall) within the maximum survey area, given the survey start date and duration.

Results of the Level B take calculations by survey segment are provided in Table 6-2. It should be noted that where necessary, calculated take has been modified based on expected increased marine mammal activity as experienced from actual survey sightings along the US East Coast (Ocean Wind LLC, 2017). As such, Bottlenose dolphin numbers have been modified to account for potential overlap of the Western North Atlantic northern migratory coastal and offshore stocks. In the instance of the North Atlantic right whale, the Applicant has proposed a 1,640.4-ft (500-m) exclusion zone which exceeds the distance to the level B harassment isopleth. An additional 328.1-ft (100-m) exclusion zone for ESA-listed large whales (e.g. fin whale) is also proposed. Given that the proposed mitigation effectively prevents level B harassment for these species, take has been adjusted to 0 individuals for North Atlantic right whales and fin whales.

Table 6-2 Marine Mammal Density and Estimated Level B Take Numbers during HRG Survey Activities

Species	Turbine Positions		Cable Route Corridor		Inter-Array Cable Area		Totals	
	Maximum Seasonal Density a/ (No./100 km²)	Calculated Take (No.)	Maximum Seasonal Density a/ (No./100 km²))	Calculated Take (No.)	Maximum Seasonal Density a/ (No./100 km²)	Calculated Take (No.)	Adjusted Take Authorization (No.)	Percent of Population
North Atlantic Right Whale	0.00	0.00	0.00	0.00	0.00	0.00	0 b/	0.00
Humpback Whale	0.02	0.10	0.02	0.39	0.02	0.10	1	0.07
Fin Whale	0.11	0.57	0.11	2.28	0.11	0.57	0 b/	0.21
Minke Whale	0.03	0.14	0.03	0.58	0.03	0.14	10 c/	0.39
Bottlenose dolphin *N. Coastal Migratory*	13.99	74.69	13.99	298.77	13.99	74.69	600 d/;e/	5.20
Bottlenose dolphin *Offshore*	13.99	74.69	13.99	298.77	13.99	74.69	100 d/;e/	0.13
Atlantic-spotted dolphin	0.90	4.80	1.23	26.29	0.90	4.80	300 c/	0.67
Short-beaked common dolphin	2.50	13.35	2.50	53.40	2.50	13.35	400 d/	0.57
White-sided dolphin	0.39	2.08	0.39	8.30	0.39	2.08	200 c/	0.41
Risso's Dolphin	0.01	0.03	0.00	0.02	0.01	0.03	0	0.00
Short-finned and long-finned pilot whale	0.06	0.31	0.02	0.53	0.06	0.31	15 e/	0.27
Harbor Porpoise	0.27	1.45	0.23	4.91	0.27	1.45	8	0.01

Notes:
a/ Density values from Duke University (Roberts et al. 2016)
b/ Proposed exclusion zones reduce take to 0 individuals.
c/Value increased to reflect typical pod size.
d/ Calculated take has been modified to account for increases in actual sighting data to date (Ocean Wind LLC, 2017) based on similar project activities.
e/ Take adjusted to account for possible overlap of the Western North Atlantic northern migratory coastal and offshore stocks.

As stated earlier, the Applicant is requesting small levels of Level A incidental take for delphinoid cetaceans. Densities and duration are the same as used for calculations of Level B, above. Results of the Level A take calculations by survey segment are provided in Table 6-3. It should be noted that where necessary, calculated take has been modified based on expected increased marine mammal activity Environmental Sciences 2016; Ocean Wind LLC, 2017). The minimal Level A take for dolphin species has been requested to specifically allow survey activities to continue, understanding the proclivity of delphinids to closely investigate active survey gear. While Table 5-2 indicates Level A PTS onset occurring within 1 m of the sound source, a 5 m zone has been adopted as a conservative measure and to provide a more reasonable monitoring zone for mitigation purposes. Given current population sizes, the resulting minimal numbers requested as take represent a fraction of a percent of total populations for each representative species. Take for delphinoid cetaceans as presented in Table 6-3 represents Level A incidental take as calculated using the parameters listed in Table 6-1.

Table 6-3 Marine Mammal Density and Estimated Level A Take Numbers during HRG Survey Activities

Species		Turbine Positions		Cable Route Corridor		Inter-Array Cable Area		Totals	
		Maximum Seasonal Density a/ (No./100 km²)	Calculated Take (No.)	Maximum Seasonal Density a/ (No./100 km²)	Calculated Take (No.)	Maximum Seasonal Density a/ (No./100 km²)	Calculated Take (No.)	Adjusted Take Authorization (No.)	Percent of Population
Bottlenose dolphin	N. Coastal Migratory	13.99	3.73	13.99	14.93	13.99	3.73	25 b/;c/	0.22
	Offshore	13.99	3.73	13.99	14.93	13.99	3.73	25 b/;c/	0.03
Atlantic-spotted dolphin		0.90	0.24	0.90	0.96	0.90	0.24	10 b/	0.02
Short-beaked common dolphin		2.50	0.67	2.50	2.67	2.50	0.67	10 b/	0.01
White-sided dolphin		0.39	0.10	0.39	0.41	0.39	0.10	10 b/	0.02
Risso's Dolphin		0.00	0.00	0.01	0.01	0.00	0.00	0	0.00

Notes:
a/ Density values from Duke University (Roberts et al. 2016)
b/ Value increased to reflect typical pod size.
c/ Take adjusted to account for possible overlap of the Western North Atlantic northern migratory coastal and offshore stocks.

7 ANTICIPATED IMPACTS OF THE ACTIVITY

Consideration of negligible impact is required for NMFS to authorize the incidental take of marine mammals. In 50 CFR § 216.103, NMFS defines negligible impact to be "an impact resulting from a specified activity that cannot be reasonably expected to, and is not reasonably likely to, adversely affect the species or stocks [of marine mammals] through effects on annual rates of recruitment or survival." Based upon best available data regarding the marine mammal species (including density, status, and distribution) that are likely to occur in the Survey Area, the Applicant concludes that exposure to marine mammal species and stocks during marine site characterization surveys would result in short-term minimal effects and would not affect the overall annual recruitment or survival for the following reasons:

- As detailed in Section 1.2 and Section 5, potential acoustic exposures from survey activities are within the non-injurious behavioral effects zone (Level B harassment) and the Level A harassment zone for certain species;
- The potential for take as estimated in Section 6.2.1 represents a highly conservative estimate of harassment based upon typical HRG survey scenarios utilizing an overly conservative ZOI and without taking into consideration the effects of standard mitigation and monitoring measures; and
- The protective measures as described in Section 11 are designed to avoid and/or minimize the potential for interactions with and exposure to marine mammals.

Marine mammals are mobile free-ranging animals and have the capacity to exit an area when noise-producing survey activities are initiated. Based on the conservative take estimations, survey activities may disturb more than one individual for some species (mainly dolphins), but in conjunction with other aforementioned factors, we conclude the short-term HRG survey activities are not expected to result in population-level effects and that individuals will return to normal behavioral patterns after activities have ceased or after the animal has left the area under survey.

8 ANTICIPATED IMPACTS ON SUBSISTENCE USES

There are no traditional subsistence hunting areas in the Survey Area.

9 ANTICIPATED IMPACTS ON HABITAT

The HRG survey equipment will not contact the seafloor and would not be a source of air or water pollution. Impact to prey species is expected to be limited to avoidance of the area around the HRG survey activities and short-term changes in behavior. Such impacts are not expected to result in population-level effects on prey species. Individuals disturbed by a survey would likely return to normal behavioral patterns after the survey has ceased or after the animal has left the survey area. Because of the limited immediate area of ensonification and duration of individual HRG surveys, few fish may be expected in most cases to be present within the survey areas (BOEM 2012).

Impact on marine mammal habitat from these activities will be negligible.

10 ANTICIPATED EFFECTS OF HABITAT IMPACTS ON MARINE MAMMALS

As stated in Section 9, the effects to marine mammals from loss or modification of habitat from the proposed survey activities will be insignificant and discountable.

11 MITIGATION MEASURES

The Applicant commits to engaging in ongoing consultations with NMFS. Per the Lease and RAP approval conditions, the Applicant has committed to the following comprehensive set of mitigation measures during marine UXO surveys. The mitigation procedures outlined in this section are based on protocols and procedures that have been previously approved by NMFS, successfully implemented, and resulted in no take of marine mammals for similar offshore projects(ESS 2013; Dominion 2013 and 2014). Unless otherwise specified, the following mitigation measures apply to the HRG survey activities.

Dominion, through their Engineering Procurement and Construction (EPC) contractor, Ørsted, ,will develop a training program that will be provided to all crew prior to the start of survey and during any changes in crew such that all survey personnel are fully aware and understand the mitigation, monitoring, and reporting requirements. The training program will be provided to NMFS for review and approval prior to the start of surveys. Confirmation of the training and understanding of the requirements will be documented on a training course log sheet. Signing the log sheet will certify that the crew members understand and will comply with the necessary requirements throughout the survey event.

11.1 Vessel Strike Avoidance Procedures

The Applicant will ensure that vessel operators and crew maintain a vigilant watch for cetaceans, pinnipeds, and sea turtles. Survey vessel crew members responsible for navigation duties will receive site-specific training on marine mammal and sea turtle sighting/reporting and vessel strike avoidance measures. Vessel strike avoidance measures will include, but are not limited to, the following, except under extraordinary circumstances when complying with these requirements would put the safety of the vessel or crew at risk:

- All vessel operators and crew will maintain vigilant watch for cetaceans, pinnipeds, and sea turtles

and slow down or stop their vessel to avoid striking these protected species.

- All vessel operators will comply with 10 knot (<18.5 km per hour [km/h]) speed restrictions in any Dynamic Management Area (DMA). In addition, vessels over 65 ft,(19.8 m) operating from November 1 through April 30 will operate at speeds of 10 knots (<18.5 km/h) or less.
- All vessel operators will reduce vessel speed to 10 knots or less when mother/calf pairs, pods, or larger assemblages of non-delphinoid cetaceans are observed near an underway vessel.
- All survey vessels will maintain a separation distance of 500 m or greater from any sighted North Atlantic right whale.
- If underway, vessels must steer a course away from any sited North Atlantic right whale at 10 knots (<18.5 km/h) or less until the 500 m (1,640 ft) minimum separation distance has been established. If a North Atlantic right whale is sited in a vessel's path, or within 100 m to an underway vessel, the underway vessel must reduce speed and shift the engine to neutral. Engines will not be engaged until the North Atlantic right whale has moved outside of the vessel's path and beyond 100 m. If stationary, the vessel must not engage engines until the North Atlantic right whale has moved beyond 100 m.
- All vessels will maintain a separation distance of 100 m or greater from any sighted non-delphinoid cetacean. If sighted, the vessel underway must reduce speed and shift the engine to neutral, and must not engage the engines until the non-delphinoid cetacean has moved outside of the vessel's path and beyond 100 m. If a survey vessel is stationary, the vessel will not engage engines until the non-delphinoid cetacean has moved out of the vessel's path and beyond 100 m.
- All vessels underway will not divert to approach any delphinoid cetacean or pinniped. Any vessel underway will avoid excessive speed or abrupt changes in direction to avoid injury to the sighted delphinoid cetacean or pinniped.
- All vessels will maintain a separation distance of 50 m (164 ft) or greater from any sighted sea turtle or pinniped.

11.2 Seasonal Operating Requirements

Between watch shifts throughout the HRG survey operations, members of the monitoring team will consult NMFS North Atlantic right whale reporting systems for the presence of North Atlantic right whales. The proposed survey activities will occur within the vicinity of the Right Whale Mid-Atlantic SMA at the mouth of the Chesapeake Bay. The proposed survey start date in August, 2018 is outside of the seasonal mandatory speed restriction period for this SMA (November 1 through April 30).

Throughout all survey operations, the Applicant will monitor NMFS North Atlantic right whale reporting systems for the establishment of a DMA. If NMFS should establish a DMA in the Lease Area or cable route corridor(s) under survey, within 24 hours of the establishment of the DMA the Applicant will work with NMFS to shut down and/or alter the survey activities to avoid the DMA.

11.3 Exclusion and Monitoring Zone Implementation

Use of the survey equipment as listed in Table 1-1 will be dependent on specific survey data needs. Therefore, not all data acquisition equipment will be in operation at the same time for the entire duration of

the survey. For example, the Geo-Source 800 Sparker and/or Innomar Medium 100 Sub-bottom Profiler will only be utilized as needed for specific track line investigations. The Applicant acknowledges that BOEM has required a 200-meter default exclusion zone in the RAP approval; however, the Applicant intends to consult with BOEM concerning modification to this exclusion zone. The Applicant proposes to the following exclusion and monitoring zones during operation of the HRG equipment:

- 1,640.4-ft (500-m) North Atlantic right whale exclusion zone;
- 328.1-ft (100-m) ESA-listed large whale exclusion zone;
- 164.0-ft (50-m) Level A exclusion zone for harbor porpoise;
- 16.4-ft (5-m) Level A monitoring zone for all delphinoid marine mammals; and
- 328.1-ft (100-m) Level B monitoring zone for all marine mammals except for the North Atlantic right whale and ESA-listed large whales.

These zones will be monitored as described in Sections 11.4 through 11.7.

11.4 Visual Monitoring Program

Visual monitoring of the established exclusion zones and monitoring zones will be performed by qualified and NMFS-approved Protected Species Observers (PSOs). In the case of shallow, nearshore areas, where the likelihood of encountering marine mammals is low and the size of the vessels limits the number of allowable personnel on board, a vessel crew member will be designated as an Environmental Compliance Monitor (ECM) to monitor for the presence of marine mammals and ensure compliance with mitigation, monitoring, and reporting requirements.

PSO qualifications will include direct field experience on a marine mammal/sea turtle observation vessel and/or aerial surveys in the Atlantic Ocean/Gulf of Mexico. An observer team comprising a minimum of four NMFS-approved PSOs, operating in shifts, will be stationed aboard either the survey vessel or a dedicated PSO-vessel. PSOs will work in shifts such that no one monitor will work more than 4 consecutive hours without a 2 hour break or longer than 12 hours during any 24-hour period. During daylight hours the PSOs will rotate in shifts of 1 on and 3 off, and during nighttime operations shifts will rotate such that PSOs will work in pairs. Each PSO will monitor 360 degrees of the field of vision. The Applicant will provide resumes of all proposed PSOs (including alternates) to BOEM for review and approval by NMFS prior to the start of survey operations. Each PSO will follow the specified monitoring period for each of the following survey activities:

The PSOs/ECMs will begin observation of the established exclusion zones and monitoring zones, with implementation of exclusion zone pre-clearance proceedurs described in section 11.5, at the commencement of all HRG survey operations. Observations of the zones will continue throughout the survey activity and/or while equipment operating below 200 kHz are in use. PSOs/ECMs will be responsible for visually monitoring and identifying marine mammals approaching or entering the established exclusion zones during survey activities. It will be the responsibility of the Lead PSO/ECM on duty to communicate the presence of marine mammals as well as to communicate and enforce the action(s) that are necessary to ensure mitigation and monitoring requirements are implemented as appropriate. Observations will be communicated to the Lead PSO on duty, who will then be responsible for implementing the necessary mitigation procedures. A PSO/ECM mitigation and monitoring communications flow diagram has been included as Appendix A.

The PSOs/ECM will be equipped with binoculars and have the ability to estimate distances to marine mammals located in proximity to their established zones using range finders. Reticulated binoculars will also be available to PSOs/ECMs for use as appropriate based on conditions and visibility to support the siting and monitoring of marine species. Digital single-lens reflex camera equipment will be used to record sightings and verify species identification. During night operations utilizing the Innomar Medium 100 Sub-bottom Profiler and/or Geo-Source 800 Sparker in the offshore portions of the survey area, an alternative monitoring plan will be implemented. Night-vision equipment, and infrared technology will be used by ECMs during all night operations. Position data will be recorded using hand-held or vessel global positioning system (GPS) units for each sighting. Specifications for the night-vision, and infrared equipment will be provided to both NOAA and BOEM for review and acceptance prior to the start of surveys.

Observations will take place from the highest available vantage point on the survey vessel. General 360-degree scanning will occur during the monitoring periods, and target scanning by the PSO will occur when alerted of a marine mammal presence.

Data on all PSO/ECM observations will be recorded based on standard PSO collection requirements. This will include dates and locations of construction operations; time of observation, location and weather; details of the sightings (e.g., species, age classification [if known], numbers, behavior); and details of any observed "taking" (behavioral disturbances or injury/mortality). The data sheet will be provided to both NMFS and BOEM for review and approval prior to the start of survey activities. In addition, prior to initiation of survey work, all crew members will undergo environmental training, a component of which will focus on the procedures for sighting and protection of marine mammals and sea turtles. A briefing will also be conducted between the survey supervisors and crews, the PSOs/ECMs, and the Applicant. The purpose of the briefing will be to establish responsibilities of each party, define the chains of command, discuss communication procedures, provide an overview of monitoring purposes, and review operational procedures.

11.5 Pre-Clearance of the Exclusion Zones

For operation of the Innomar Medium 100 Sub-bottom Profiler and/or Geo-Source 800 Sparker, the Applicant will implement a 30-minute clearance period of the exclusion zones prior to the initiation of ramp-up (Section 11.6). During this period, the exclusion zones will be monitored by the PSOs, using the appropriate visual technology for a 30-minute period. No night vision, or thermal equipment will be used for shallow, nearshore segments of the survey area, as survey activities on a smaller, shallow-draft vessel, will only be conducted during daylight hours (defined as 30 minutes after dawn to 30 minutes before dusk). Ramp-up may not be initiated if any marine mammal is within its respective exclusion zone. If a marine mammal is observed within an exclusion zone during the pre-clearance period, ramp-up may not begin until the animal(s) has been observed exiting its respective zone or until an additional time period has elapsed with no further sightings (i.e., 15 minutes for small odontocetes and pinnipeds and 30 minutes for all other species).

11.6 Ramp-Up Procedures

Where technically feasible, a ramp-up procedure will be used for HRG survey equipment capable of adjusting energy levels at the start or re-start of HRG survey activities. A ramp-up procedure will be used

at the beginning of HRG survey activities in order to provide additional protection to marine mammals near the Survey Area by allowing them to vacate the area prior to the commencement of survey equipment use. The ramp-up procedure will not be initiated and no equipment will be powered on, regardless of whether or not the equipment is capable of ramp-up, during periods of inclement conditions if the exclusion zone cannot be adequately monitored by the PSOs using the appropriate visual technology for a 30-minute period. A ramp-up would begin with the powering up of the smallest acoustic HRG equipment at its lowest practical power output appropriate for the survey. When technically feasible, the power would then be gradually turned up and other acoustic sources added in way such that the source level would increase in steps not exceeding 6 B per 5-minute period.

Ramp-up activities will be delayed if a marine mammal(s) enters an exclusion zone(s). Ramp-up will not continue until the animal has been observed exiting its respective exclusion zone or until an additional time period has elapsed with no further sighting (i.e. 15 minutes for small odontocetes and 30 minutes for all other species).

11.7 Shut-Down and Power-Down Procedures

The exclusion and monitoring zone around the noise-producing activities will be maintained, as previously described, by PSOs for the presence of marine mammals before, during, and after any noise-producing activity. The vessel operator will comply immediately with any call for shutdown by the Lead PSO.

An immediate shut-down of the HRG survey equipment will be required if a marine mammal is sighted at or within its respective exclusion zone (as defined in Section 11.3). For delphinoid cetaceans and harbor porpoise, the Applicant has specifically requested Level A incidental take considering these species' propensity to voluntarily approach the vessel and all noise sources. For seals, non-delphinoid cetaceans and, in particular, the North Atlantic right whale, the vessel operator will comply immediately with any call for shut-down by the Lead PSO/ECM. Any disagreement between the Lead PSO/ECM and vessel operator will be discussed only after shut-down has occurred. Subsequent restart of the survey equipment can be initiated if the animal has been observed exiting its respective exclusion zone within 30 minutes of the shut-down or after an additional time period has elapsed with no further sighting (i.e., 15 minutes for small odontocetes and 30 minutes for all other species).

If the acoustic source is shut down for reasons other than mitigation (e.g., mechanical difficulty) for brief periods (i.e., less than 30 minutes), it may be activated again without ramp-up, if PSOs/ECM have maintained constant observation and no detections of any marine mammal have occurred within the respective exclusion zones.

If the acoustic source is shut-down for a period longer than 30 minutes and PSOs have maintained constant observation, then ramp-up procedures will be initiated as described in Section 11.6.

12 ARCTIC PLAN OF COOPERATION

Potential impacts to species or stocks of marine mammals will be limited to individuals of marine mammal species located in the northeast region of the United States, and will not affect Arctic marine mammals. Given that the Project is not located in Arctic waters, the activities associated with the Applicant's marine characterization surveys will not have an adverse effect on the availability of marine mammals for subsistence uses allowable under the MMPA.

13 MONITORING AND REPORTING

13.1 Monitoring

Visual monitoring protocols are described in Section 11.

13.2 Reporting

The Applicant will provide the following reports, as necessary, during HRG survey activities:

- The Applicant will contact BOEM and NMFS within 24 hours of the commencement of survey activities and again within 24 hours of the completion of the activity;
- The Applicant will report any observed injury or mortality in accordance with NMFS' standard reporting guidelines; and
- Within 90 days after completion of survey activities, a draft technical report will be provided to BOEM and NMFS that fully documents the methods and monitoring protocols, summarizes the data recorded during monitoring, estimates the number of listed marine mammals that may have been incidentally taken during survey activities, and provides an interpretation of the results and effectiveness of all monitoring tasks. Any recommendations made by NMFS will be addressed in the final report prior to acceptance by NMFS.

14 SUGGESTED MEANS OF COORDINATION RESEARCH

All marine mammal data collected by the Applicant during HRG survey activities will be provided to NMFS, BOEM, and other interested government agencies, and will be made available upon request to educational institutions and environmental groups. These organizations could use the data collected to study ways to reduce incidental harassment and evaluate its effects.

All hydroacoustic data and resulting transmission loss rates collected during field verification of the safety and/or exclusion zones by the Applicant during HRG surveys will be provided to NMFS, BOEM, and other interested government agencies, and be made available upon request to educational institutions and environmental groups. These organizations could use the data collected to study ways to reduce incidental taking from survey activities and evaluate its effects.

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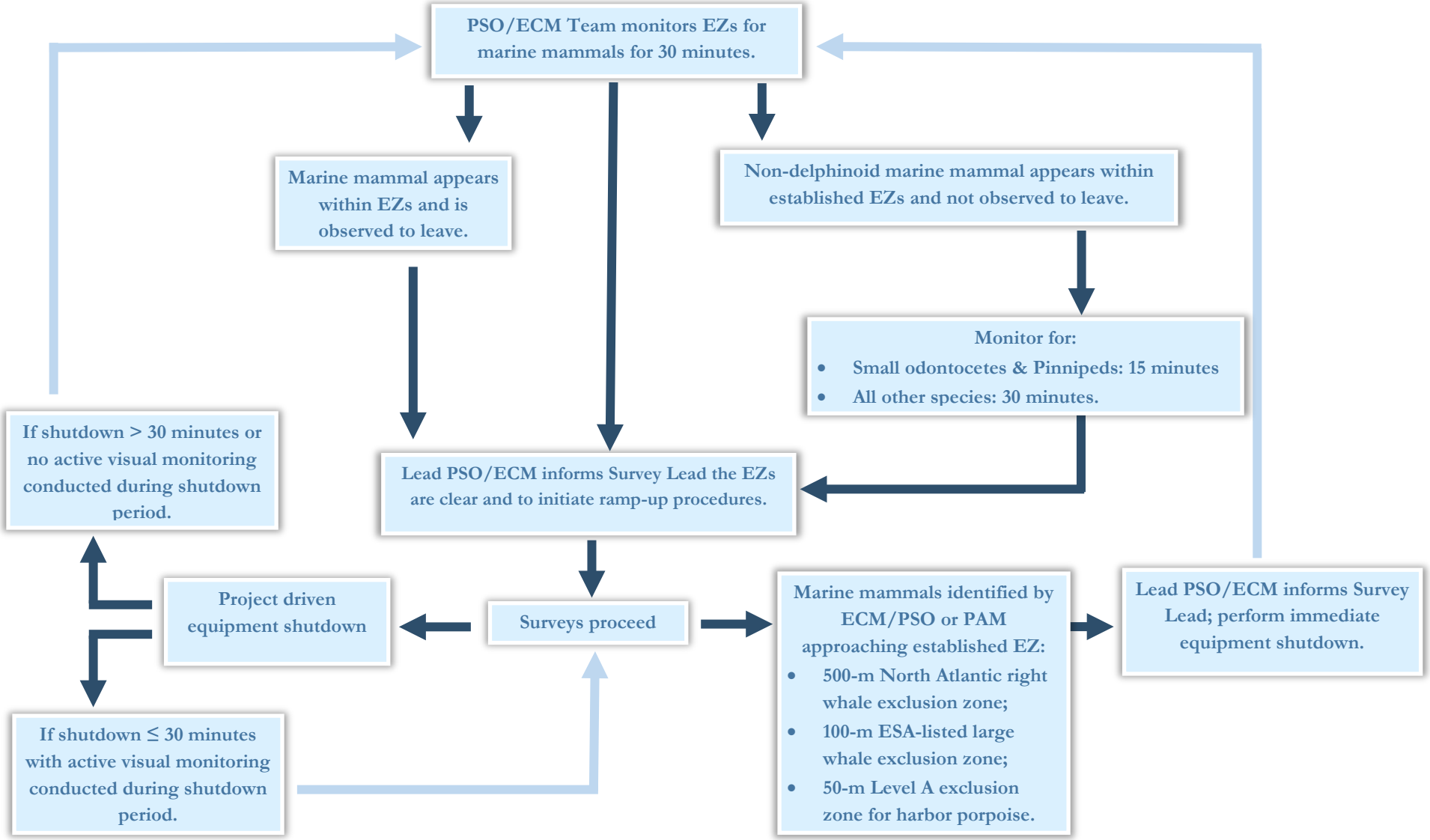
APPENDIX A – COASTAL VIRGINIA OFFSHORE WIND FARM – MITIGATION AND MONITORING COMMUNICATIONS FLOW DIAGRAM



LEGEND

ECM	–	Environmental Compliance Monitor
EZ	–	Exclusion Zone
PSO	–	Protected Species Observer