New England Wind Offshore Wind Farm

Updates to the Application for Marine Mammal Protection Act (MMPA) Rulemaking and Letter of Authorization

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Permits and Conservation Division,
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JASCO APPLIED SCIENCES

1. Introduction

Park City Wind LLC (Park City Wind), a wholly owned subsidiary of Avangrid Renewables, LLC (Proponent), is proposing to develop offshore renewable wind energy facilities in the Bureau of Ocean Energy Management (BOEM) Lease Area OCS-A 0534 along with associated offshore and onshore cabling, onshore substations, and onshore operations and maintenance (O&M) facilities. The New England Wind Offshore Wind Farm's (New England Wind; Project) offshore renewable wind energy facilities are located immediately southwest of Vineyard Wind 1, which is located in Lease Area OCS-A 0501. New England Wind will occupy all of Lease Area OCS-A 0534 and potentially a portion of Lease Area OCS-A 0501 in the event that Vineyard Wind 1 does not develop "spare" or extra positions included in Lease Area OCS-A 0501 and Vineyard Wind 1 assigns those positions to Lease Area OCS-A 0534. For the purposes of this document, the Southern Wind Development Area (SWDA) is defined as all of Lease Area OCS-A 0534 and the southwest portion of Lease Area OCS-A 0501, as shown in Figure 1.

New England Wind will be developed in two Phases with a maximum of 130 wind turbine generator (WTG) and electrical service platform (ESP) positions. Two positions may potentially have co-located ESPs (i.e., two foundations installed at one grid position), resulting in 132 foundations. Phase 1 will be developed immediately southwest of the Vineyard Wind 1 project. The Phase 1 Envelope allows for 41 to 62 WTGs and one or two ESP(s). Depending upon the capacity of the WTGs, Phase 1 will occupy 150–231 km^2 (37,066–57,081 acres) of the SWDA. The Phase 1 Envelope includes two WTG foundation types: monopiles and piled jackets. Phase 2, also known as Commonwealth Wind, will be immediately southwest of Phase 1 and will occupy the remainder of the SWDA. The footprint and total number of WTG and ESP positions in Phase 2 depends upon the final footprint of Phase 1; Phase 2 is expected to contain 64 to 88 WTG/ESP positions (up to three positions will be occupied by ESPs) within an area ranging from 222–303 km^2 (54,857–74,873 acres). The Phase 2 Envelope includes three general WTG foundation types: monopiles, jackets (with piles or suction buckets), or bottom-frame foundations (with piles or suction buckets).

The Proponent submitted a request for rulemaking and Letter of Authorization (LOA) pursuant to Section 101(a)(5) of the Marine Mammal Protection Act (MMPA) and 50 CFR Part 216 Subpart I to allow for the incidental harassment of small numbers of marine mammals resulting from: 1) the installation of WTGs and ESPs with methods of impact pile driving, vibratory pile setting, and drilling, 2) potential detonations of unexploded ordnances (UXO), and 3) the performance of high-resolution geophysical (HRG) surveys operating at less than 180 kHz. The LOA application was deemed adequate and complete on July 20, 2022, and a Notice of Receipt of the LOA application was published in the Federal Register on August 22, 2022 (87 FR 51345). A Proposed Rule for New England Wind was published in the Federal Register on June 8, 2023.

After the Proposed Rule was issued in June 2023, revisions to the modeling approach for impact pile driving and vibratory modeling have been made, along with updated acoustic drilling modeling, and treatment of species guilds – all resulting in a reduction in expected take. This document summarizes all updates made since the Proposed Rule.

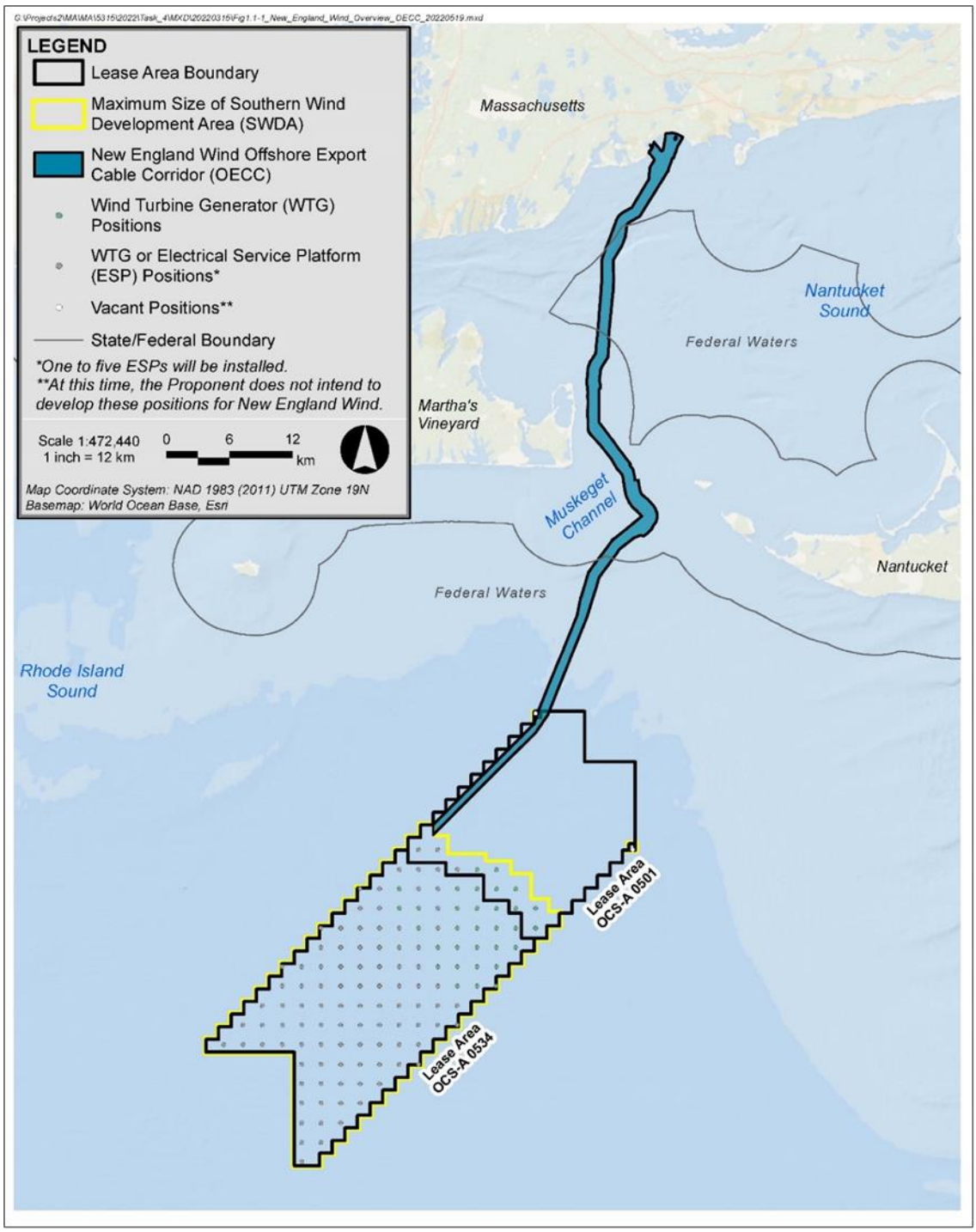

Figure 1. Location of New England Wind SWDA within Lease Area OCS-A 0534 and the SW portion of Lease Area OCS-A 0501.

1.1. Species Considered

Species that are common, uncommon, and regular (i.e., have the likelihood of occurring at least seasonally in the Offshore Development Area) near the lease area were considered in this supplemental analysis. These species include the NARW, humpback whale, fin whale, sei whale, minke whale, bottlenose dolphin, short- and long-finned pilot whales, Risso's dolphin, short-beaked common dolphin, sperm whale, Atlantic white-sided dolphin, Atlantic spotted dolphin, harbor porpoise, gray seal, harbor seal, and harp seal (([BOEM] Bureau of Ocean Energy Management 2019); Section 4 and Section 6 of the LOA). For rare species, with densities too low to provide meaningful model results, no new analysis was done and take request based on the species' average group size is unchanged (Section 6.2 and Section 6 of the LOA).

1.2. Density Updates

Densities described in the Proposed Rule and contained within this document are based on the Duke Marine Geospatial Ecology Lab's marine mammal density models for the U.S. east coast (Roberts et al. 2022), available at https://seamap.env.duke.edu/models/Duke/EC/.

Additionally, as a new update for this January 2024 LOA Update Memo (i.e., as an update following the Proposed Rule), and as directed by NMFS, updates were also made to the density calculations for guilded species for the modeling efforts completed in 2023- vibratory setting followed by impact pile driving, impact pile driving alone, and drilling. When calculating exposures for individual pilot whale and seal species, the guild densities provided by Roberts et al. (2016a, 2022) were scaled by the relative abundances of the species in each guild, using the best available estimates of local abundance, to get species-specific density estimates surrounding the Lease Area (see Section 2 for further details).

1.3. Construction Schedule

The construction schedule is the same as described in the Proposed Rule and is reproduced here for completeness; no further schedule updates are being made in this January 2024 LOA Update Memo.

The New England Wind LOA application describes construction activities that would span a period of 5 years from 2025 through 2029. Year 1 is assumed to be 2025, Year 2 is assumed to be 2026, Year 3 is assumed to be 2027, Year 4 is assumed to be 2028, and Year 5 is assumed to be 2029. The application describes two possible construction schedules that could take place during these 5 years: Construction schedule A and Construction schedule B.

As described in the LOA application and March 2023 LOA Update Memo, Construction schedule A assumes a conservative, yet realistic two-year construction scenario whereby 54 Phase 1 WTGs are installed on monopiles, 53 Phase 2 WTGs are installed on monopiles, 23 Phase 2 WTGs are installed on jackets, and each Phase includes one ESP on a jacket foundation.[1] Construction schedule A also assumes that foundations for all of Phase 1 and a portion of Phase 2 are installed in Year 1, and that the remaining Phase 2 foundations are installed in Year 2. Overall, under this schedule, 89 monopile foundations and two jacket foundations would be installed in Year 1 and 18 monopile and 24 jacket foundations would be installed in Year 2.

As described in the LOA application and March 2023 LOA Update Memo, Construction schedule B assumes a conservative, yet realistic three-year construction scenario where 55 Phase 1 WTGs are

[1] Construction schedule A also includes one additional jacket foundation for a reactive compensation station (RCS), which has been eliminated from the design of New England Wind.

installed on monopiles, 75 Phase 2 WTGs are installed on jackets, and each Phase includes one ESP on a jacket foundation.[2] Construction schedule B assumes that all ESP foundations and Phase 1 WTG foundations are installed in Year 1 and that the Phase 2 WTG foundations are installed in Years 2 and 3. Overall, under this schedule, 55 monopiles and three jacket foundations would be installed in Year 1, 53 jacket foundations would be installed in Year 2 and 22 jacket foundations would be installed in Year 3.

The following table (Table 1) summarizes the construction schedule. Each construction schedule includes a combination of foundations installed with impact pile driving alone and foundations installed with vibratory setting of the pile followed by impact pile driving. The modeled duration of vibratory hammering was 60 minutes for all foundation types that included vibratory setting of the pile. Detailed, updated construction schedules are provided in Tables 2–4.

Table 1. A summary of the proposed Project activity and the associated year.

Activity	Year 1 (2025)	Year 2 (2026)	Year 3 (2027)	Year 4 (2028)	Year 5 (2029)
Foundation installation (i.e., impact pile driving, vibratory pile setting, and drilling)		X	X	X	
Potential UXO detonation	X	X			
HRG surveys	X	X	X	X	X

* = foundation installation would only occur in this year if Construction schedule B is assumed.

Table 2. Pile Installation Construction Schedule A Total: The number of potential days of pile installation per month under the maximum design scenario used to estimate the total number of marine mammal acoustic exposures for New England Wind.

Month	Schedule A Total [a]			
	Total days of impact only piling	Total days with vibratory + impact piling [b]	Days with drilling [c]	Schedule A Total days of foundation installation [c]
May	8	0	3	8
June	6	4	6	10
July	5	8	9	13
August	3	14	11	17
September	7	10	10	17
October	5	7	5	12
November	3	2	4	5
December	5	0	0	5
	42	**45**	**48**	**87**
Total days	**87 days**			
Total foundations	**133 foundations**			
Total piles	**211 piles**			

[a] This LOA request is for the 5-year period 2025–2029, during which pile installation is scheduled to begin in 2026. These dates reflect the currently projected construction start year and are subject to change because exact project start dates and construction schedules are not currently available. No concurrent/simultaneous pile driving of foundations is planned.

[b] The number of days with vibratory hammering or drilling is based on a percentage of the number of days of pile installation and includes installation of a mix of monopiles at a rate of both 1 per day and 2 per day as well as installation of jacket foundations at a rate of four pin piles per day. The number of Level B takes **per day** is unaffected by the number of piles or foundations installed in that day because the SPL 120 dB metric is not

[2] Construction schedule B also includes one additional jacket foundation for an RCS, which has been eliminated from the design of New England Wind.

cumulative. Level B take was estimated using density-based calculations that assume all animals within the area ensonified to 120 dB are taken as soon as the activity begins and cannot be taken additional times within one day. Only Level B takes are being requested for drilling and vibratory hammering.

[c] As a conservative measure, it was assumed that vibratory hammering and drilling would not occur on the same day, when possible. However, for months when the number of days with vibratory hammering plus the number of days with drilling exceeded the total number of impact piling days that month, we assumed the minimum number of days of overlap possible for these two activities. On the days with overlap between drilling and vibratory hammering, the estimated Level B takes resulting from drilling were not included to avoid double counting taken animals, because all animals within the larger vibratory hammering zone of influence were assumed to have already been taken by that activity. Level B takes for 8 days of drilling in year 2 (2026) and 9 days of drilling in year 3 (2027) shown in Schedule A were thus not included in the total take estimates.

Table 3. Pile Installation Construction Schedule A Year 2 and 3: The number of potential days of pile installation per month under the maximum design scenario used to estimate the total number of marine mammal acoustic exposures for New England Wind.

Month	Year 2 (2026) a									Year 3 (2027)						
	12 m Monopile 5,000 kJ		13 m Monopile 5,000 kJ		4 m Pin pile 3,500 k J	Total days of impact only piling	Total days with vibratory + impact piling [b]	Days with drilling [c]	Year 2 Total days of foundation Installation [c]	12 m Monopile 6,000 kJ		4 m Pin Pile 3,500 k J	Total days of impact only piling	Total days with vibratory + impact piling [b]	Days with drilling [c]	Year 3 Total days of foundation Installation [c]
	1 per day	2 per day	1 per day	2 per day	4 per day					1 per day	2 per day	1 per day				
May	4	0	0	0	0	4	0	2	4	4	0	0	4	0	1	4
June	2	5	0	0	0	5	2	4	7	0	3	0	1	2	2	3
July	0	9	0	0	0	5	4	7	9	0	4	0	0	4	2	4
August	0	9	0	0	0	3	6	7	9	0	0	8	0	8	4	8
September	0	1	1	6	2	6	4	8	10	0	0	7	1	6	2	7
October	0	0	0	6	0	3	3	3	6	0	0	6	2	4	2	6
November	0	0	0	3	0	2	1	2	3	0	0	2	1	1	2	2
December	0	0	4	0	0	4	0	0	4	0	0	1	1	0	0	1
	6	**24**	**5**	**15**	**2**	**32**	**20**	**33**	**52**	**4**	**7**	**24**	**10**	**25**	**15**	**35**
Total days	**52 days**									**35 days**						**87 days**
Total foundations	**89 monopiles and 2 jackets**									**18 monopiles and 24 jackets**						**133 foundations**
Total piles	**89 monopiles and 8 pin piles**									**18 monopiles and 96 pin piles**						**211 piles**

[a] This LOA request is for the 5-year period 2025–2029, during which pile installation is scheduled to begin in 2026. These dates reflect the currently projected construction start year and are subject to change because exact project start dates and construction schedules are not currently available. No concurrent/simultaneous pile driving of foundations is planned.

[b] The number of days with vibratory hammering or drilling is based on a percentage of the number of days of pile installation and includes installation of a mix of monopiles at a rate of both 1 per day and 2 per day as well as installation of jacket foundations at a rate of four pin piles per day. The number of Level B takes **per day** is unaffected by the number of piles or foundations installed in that day because the SPL 120 dB metric is not cumulative. Level B take was estimated using density-based calculations that assume all animals within the area ensonified to 120 dB are taken as soon as the activity begins and cannot be taken additional times within one day. Only Level B takes are being requested for drilling and vibratory hammering.

[c] As a conservative measure, it was assumed that vibratory hammering and drilling would not occur on the same day, when possible. However, for months when the number of days with vibratory hammering plus the number of days with drilling exceeded the total number of impact piling days that month, we assumed the minimum number of days of overlap possible for these two activities. On the days with overlap between drilling and vibratory hammering, the estimated Level B takes resulting from drilling were not included to avoid double counting taken animals, because all animals within the larger vibratory hammering zone of influence were assumed to have already been taken by that activity. Level B takes for 8 days of drilling in year 2 (2026) and 9 days of drilling in year 3 (2027) shown in Schedule A were thus not included in the total take estimates.

Table 4. Pile Installation Construction Schedule B Total: The number of potential days of pile installation per month under the maximum design scenario used to estimate the total number of marine mammal acoustic exposures for New England Wind.

Month	Schedule B Total [a]			
	Total days of impact only piling	Total days with vibratory + impact piling [b]	Days with drilling [c]	Schedule B Total days of foundation installation [c]
May	6	0	4	6
June	17	6	10	23
July	15	11	9	26
August	10	16	9	26
September	7	10	9	17
October	0	8	4	8
November	2	3	3	5
December	2	0	0	2
	59	**54**	**48**	**113**
Total Days	**113 days**			
Total Foundations	**133 foundations**			
Total Piles	**367 piles**			

[a] This LOA request is for the 5-year period 2025–2029, during which pile installation is scheduled to begin in 2026. These dates reflect the currently projected construction start year and are subject to change because exact project start dates and construction schedules are not currently available. No concurrent/simultaneous pile driving of foundations is planned.

[b] The number of days with vibratory hammering or drilling is based on a percentage of the number of days of pile installation and includes installation of a mix of monopiles at a rate of both 1 per day and 2 per day as well as installation of jacket foundations at a rate of four pin piles per day. The number of Level B takes per day is unaffected by the number of piles or foundations installed in that day because the SPL 120 dB metric is not cumulative. Level B take was estimated using density-based calculations that assume all animals within the area ensonified to 120 dB are taken as soon as the activity begins and cannot be taken additional times within one day. Only Level B takes are being requested for drilling and vibratory hammering.

[c] As a conservative measure, it was assumed that vibratory hammering and drilling would not occur on the same day, when possible. However, for months when the number of days with vibratory hammering plus the number of days with drilling exceeded the total number of impact piling days that month, we assumed the minimum number of days of overlap possible for these two activities. On the days with overlap between drilling and vibratory hammering, the estimated Level B takes resulting from drilling were not included to avoid double counting taken animals, because all animals within the larger vibratory hammering zone of influence were assumed to have already been taken by that activity. Level B takes for 9 days of drilling in year 2 (2026), 2 days of drilling in year 3 (2027), and 2 days of drilling in year 4 (2028) shown in Schedule B were thus not included in the total take estimates.

Table 5. Pile Installation Construction Schedule B Years 2,3, and 4: The number of potential days of pile installation per month under the maximum design scenario used to estimate the total number of marine mammal acoustic exposures for New England Wind.

Month	Year 2 (2026)a							Year 3 (2027)					Year 4 (2028)				
	12 m Monopile 5,000 kJ		4 m Pin pile 3,500 kJ	Total days of impact only piling	Total days with vibratory + impact piling [b]	Days with drilling [c]	Year 2 Total days of foundation installation [c]	4 m Pin pile 3,500 kJ	Total days of impact only piling	Total days with vibratory + impact piling [b]	Days with drilling [c]	Year 3 Total days of foundation installation [c]	4 m Pin pile 3,500 kJ	Total days of impact only piling	Total days with vibratory + impact piling [b]	Days with drilling [c]	Year 4 Total days of foundation installation [c]
	1 per day	2 per day	4 per day					4 per day					4 per day				
May	4	0	0	4	0	2	4	1	1	0	1	1	1	1	0	1	1
June	6	4	0	8	2	4	10	9	7	2	4	9	4	2	2	2	4
July	0	7	0	3	4	3	7	14	9	5	4	14	5	3	2	2	5
August	1	5	1	1	6	4	7	14	6	8	4	14	5	3	2	1	5
September	0	3	1	0	4	4	4	8	3	5	4	8	5	4	1	1	5
October	1	1	1	0	3	2	3	4	0	4	1	4	1	0	1	1	1
November	2	0	0	1	1	1	2	2	1	1	1	2	1	0	1	1	1
December	1	0	0	1	0	0	1	1	1	0	0	1	0	0	0	0	0
	15	**20**	**3**	**18**	**20**	**20**	**38**	**53**	**28**	**25**	**19**	**53**	**22**	**13**	**9**	**9**	**22**
Total days	**38 days**							**53 days**					**22 days**				
Total foundations	**55 monopiles and 3 jackets**							**53 jackets**					**22 jackets**				
Total piles	**55 monopiles and 12 pin piles**							**212 pin piles**					**88 pin piles**				

[a] This LOA request is for the 5-year period 2025–2029, during which pile installation is scheduled to begin in 2026. These dates reflect the currently projected construction start year and are subject to change because exact project start dates and construction schedules are not currently available. No concurrent/simultaneous pile driving of foundations is planned.

[b] The number of days with vibratory hammering or drilling is based on a percentage of the number of days of pile installation and includes installation of a mix of monopiles at a rate of both 1 per day and 2 per day as well as installation of jacket foundations at a rate of four pin piles per day. The number of Level B takes per day is unaffected by the number of piles or foundations installed in that day because the SPL 120 dB metric is not cumulative. Level B take was estimated using density-based calculations that assume all animals within the area ensonified to 120 dB are taken as soon as the activity begins and cannot be taken additional times within one day. Only Level B takes are being requested for drilling and vibratory hammering.

[c] As a conservative measure, it was assumed that vibratory hammering and drilling would not occur on the same day, when possible. However, for months when the number of days with vibratory hammering plus the number of days with drilling exceeded the total number of impact piling days that month, we assumed the minimum number of days of overlap possible for these two activities. On the days with overlap between drilling and vibratory hammering, the estimated Level B takes resulting from drilling were not included to avoid double counting taken animals, because all animals within the larger vibratory hammering zone of influence were assumed to have already been taken by that activity. Level B takes for 9 days of drilling in year 2 (2026), 2 days of drilling in year 3 (2027), and 2 days of drilling in year 4 (2028) shown in Schedule B were thus not included in the total take estimates.

1.4. Potential UXO Detonation Schedule

The UXO detonation schedule was described in the Proposed Rule and is reproduced here for completeness; no further UXO detonation schedule updates are being made in this January 2024 LOA Update Memo.

As described in Section 1.2.4 of the LOA application (July 2022), the Proponent has commissioned a UXO desktop study in which a comprehensive historic analysis of all activities which may have contributed to potential UXO-related contamination have been considered and are summarized. The modeling for UXOs, including exposure estimates has not changed, but the schedule has, so the UXO estimates are included in this supplement.

As part of the earlier study, a baseline threat assessment was conducted to assign a risk level to the different geographic areas within the New England Wind project area. The study identified moderate risk areas within the New England Wind project area and these areas are shown on Figure 2 (all other areas of New England Wind are low risk). A moderate risk is identified when evidence suggests that there is UXO present in the area (i.e., when there is a possibility of encountering UXO), activities may result in UXO detonation, and present receptors are at risk of experiencing an adverse response following detonation. Proactive UXO Mitigation is required for moderate risk (see Table 6).

Table 6. Risk level definitions.

Risk level	Definition
High	Indisputable evidence that there is a risk from this type of UXO in the area. Proactive UXO Mitigation is required.
Moderate	Evidence suggests that there is a risk from this type of UXO in the area. Proactive UXO Mitigation is required.
Low	Some evidence suggests that there is a risk from this type of UXO in the area or wider region. Reactive mitigation may be required.
Negligible	No evidence suggesting that there is a risk from this type of UXO in the area or wider region. No further mitigation is required.

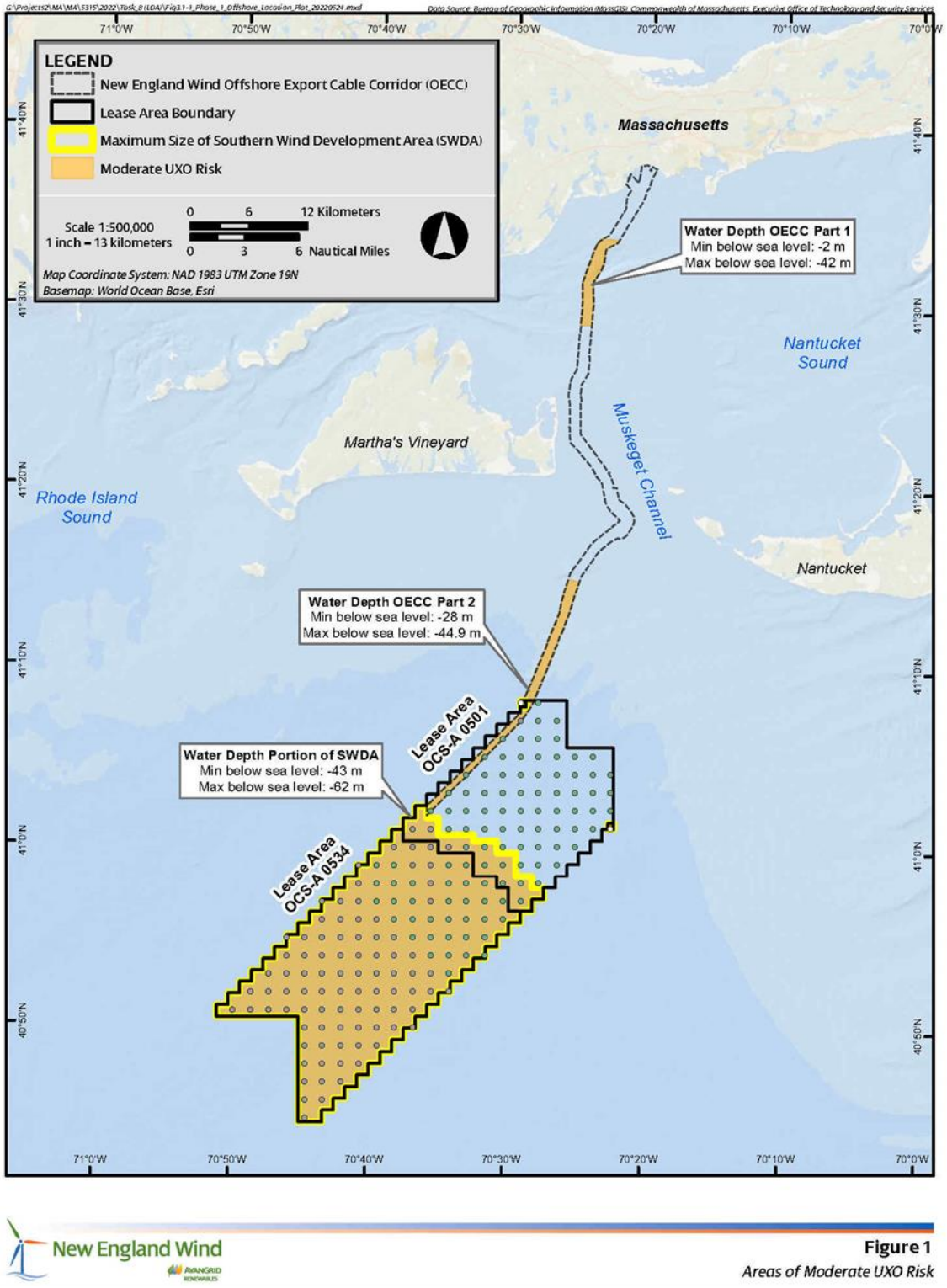

Figure 2. Potential areas of moderate risk for unexploded ordnance (UXO) presence. Source: Figure 1 of Mills (2021).

Based on ongoing development of the construction schedule, the Proponent expects that some UXO detonation activities could occur in 2025, prior to work in the offshore export cable corridor (OECC) and/or SWDA in 2026. Accordingly, the Proponent is distributing its UXO take estimates across two potential years, Year 1 (2025) and Year 2 (2026), and no changes are being made to the number of potential UXO detonations or associated water depths. Specifically, the Proponent estimates that six detonations may occur in Year 1 and four may occur in Year 2. The UXO exposures and take estimates within this update memo assume that six detonations would occur in 2025 and four would occur in 2026 (Table 7).

Table 7. Potential UXO detonation schedule.

Potential UXO Detonation Schedule	
Year 1 (2025)	**Year 2 (2026)**
2 UXOs at 12 m	0 UXOs at 12 m
3 UXOs at 20 m	0 UXOs at 20 m
1 UXOs at 30 m	2 UXOs at 30 m
0 UXOs at 40 m	2 UXOs at 40 m
Total UXOs = **10**	

Maximum monthly UXO densities were calculated in the LOA application within the moderate UXO risk areas for each species. These areas are identified as the shallow segment of the OECC (representing the 12 m depth location) and the combined deepwater segment of the OECC and SWDA (20–62 m depths). However, the attenuated SEL-based acoustic ranges extend beyond these areas (see Table 42 of the LOA application). To capture all density data within the highest possible impact area, the largest SEL-based TTS-onset acoustic ranges, assuming 10 dB of attenuation, across all hearing groups was applied to the moderate UXO risk areas (Figure 5), and these areas are used to calculate the maximum monthly marine mammal densities in this document (Table 12).

New England Wind also includes the South Coast Variant, which is a variation of the Phase 2 OECC that diverges from the OECC at the northern boundary of Lease Area OCS-A 0501 and travels west-northwest to the state waters boundary near Buzzards Bay. The Proponent would only employ the South Coast Variant if technical, logistical, grid interconnection, or other unforeseen issues arise during the COP review and engineering processes that preclude one or more Phase 2 export cables from interconnecting at the West Barnstable Substation. There is a potential risk of encountering UXO within the South Coast Variant; however, the South Coast Variant is in the same general region as the rest of the OECC and has water depths within the ranges shown in Table 7. If UXO detonation were required in the South Coast Variant, the maximum number of detonations in the OECC and South Coast Variant combined would not exceed 10. No additional exposures or take beyond the values included in Sections 4.3and 5.3 for UXO detonations are expected if the South Coast Variant is used and UXO detonation is required.

1.5. Drilling Update

Following the Proposed Rule, new modeling was performed for drilling. This January 2024 LOA Update Memo describes the new modeling methodology for drilling, which replaces the practical spreading loss approach described in the Proposed Rule. As described further below, acoustic modeling was completed for drilling and exposures were calculated by multiplying the zone of influence (ensonified area) by density. The number of foundations anticipated to require drilling is unchanged from the Proposed Rule.

As previously described, there may be instances during construction where large sub-surface boulders or hard sediment layers are encountered, requiring drilling to pass through these barriers. The Proponent conducted a seabed drivability analysis[3] to estimate the number of foundation positions that could potentially require drilling during pile installation. The analysis suggested that up to 30% of foundations (~40 foundations) could require drilling[4]. The LOA application assumed 20% conservatism to this estimate (20% of 40 is ~8 additional foundations), resulting in approximately 48 total foundations (36% of all proposed foundations) that may require drilling. The number of foundations anticipated to require drilling (48) is unchanged from the Proposed Rule.

As described in the Proposed Rule, a source level up to 193.3 dB re 1 µPa was estimated by Austin et al. (2018) using environmental propagation models designed for that location; it was therefore assumed that pile installation drilling produces similar sound levels as mudline cellar drilling. As a new update following the Proposed Rule, drilling was modeled instead of the practical spreading loss approach previously used. To model drilling, the three representative source levels estimated by Austin et al. (2018) for the 10–32,000 Hz band were averaged with an average broadband level of 191.6 dB re 1 $\mu Pa^2 \cdot s\ m^2$. The average source levels per decidecade band center frequency were used in JASCO's Marine Operations Noise Model (MONM) to predict SEL and SPL sound fields up to 1 kHz, and a Bellhop ray tracing model (Porter and Liu 1994) was used from 1–32 kHz, at a representative location near the proposed drilling sites considering the influence of bathymetry, seabed, water sound speed, and water attenuation. Modeling methods and assumptions can be found in more detail in the Drilling Tech Memo NE Wind, sub-appendix J to the acoustic modeling report (Appendix III-M of the COP). Exposures were calculated for one day of drilling, modeled at three site locations. Exposures were calculated for each of these locations individually and for the maximum potential exposures using the maximum ensonified area for each threshold. Exposures were estimated using the monthly animal densities from May to December.

The Proponent expects to employ the same noise attenuation systems (NAS) during all drilling activity for WTG and ESP foundations as used during impact driving. Drilling produces sound of similar frequency content as impact pile driving, so the NAS performance, at sufficient distance to attenuate sound entering the water from the substrate, would be expected to have essentially the same performance during drilling as impact pile driving. For this reason, results with broadband attenuation of 10 dB and 12 dB during the summer were calculated. And, like other sources, 10 dB of attenuation is assumed for exposure estimates and presented here. The acoustic ranges to the marine mammal PTS injury are less than 65 m at the three sites for all marine mammal hearing groups.

[3] The analysis of how many foundations may require drilling considered both geophysical and geotechnical data and potential contractor means and methods. The data considered include geophysical trackline data, deep boreholes, deep downhole cone penetrometer tests (CPTs), seabed CPTs, and vibracores. The Proponent also considered information on equipment types and installation methods that is being obtained from potential contractors during the ongoing procurement process.

[4] The seabed drivability analysis estimated the number of foundation positions that would require drilling. No assumptions were made about the type of foundation installed at these positions. Because the drilling exposure analysis was completed assuming 24 hours of drilling would be conducted per day of activity, the type of foundation does not matter for the purpose of estimating marine mammal exposures. Therefore, the drilling exposure estimates are conservative.

The following behavioral acoustic ranges are reported as the range of results from the three modeling locations. The maximum, unweighted, marine mammal behavioral acoustic ranges, assuming 10 dB attenuation, were found to extend to 7.50–7.64 km. Excluding 5% of the farthest points ($R_{95\%}$), the behavioral threshold ranges were 6.85–7.01 km. The unweighted SPL levels at 750 m were 135.25–136.33 dB re 1 µPa during the summer. The corresponding unweighted cumulative SEL levels at 750 m are 185.07–185.24 dB re 1 µPa^2·s during the summer. At all sites, the behavioral threshold ranges were approximately equidistant in all directions.

The PTS ranges have been calculated under a conservative assumption that drilling occurs 24 hours a day, regardless of foundation or pile type. Due to the small size of the PTS ranges and the mitigation described in the LOA application and below, the Proponent is not requesting any Level A take of marine mammals for drilling activity. The Project has committed to certain mitigation and monitoring measures which are intended to reduce the risk for Level A take. A pre-clearance and continuous monitoring program throughout pile driving and drilling is described in the LOA application. Shutdown zones identified in **Error! Reference source not found.** (Section 7) and are several times larger than the calculated PTS ranges for drilling activity. Therefore no Level A take is expected.

1.6. Impact Pile Driving Update

Following the Proposed Rule, the modeling methodology for impact pile driving and vibratory pile setting (Section 1.7) was refined. In the prior modeling (impact pile driving for the July 2022 LOA application), an energy-based parabolic equation (PE) model (JASCO's MONM) was used to compute the near-field equivalent source before long range propagation. In this update, JASCO's Full-Wave PE RAM model (FWRAM) was used to compute the near-field equivalent source before the long-range propagation was computed (also using FWRAM). FWRAM is an improvement because it calculates full synthetic pressure waveforms (in the time domain), as opposed to summed energy independent of time. Like MONM, FWRAM is range dependent for range-varying marine acoustic environments and takes environmental inputs (bathymetry, water sound speed profile, and seabed geoacoustic profile) into account. FWRAM computes pressure waveforms via Fourier synthesis of the modeled acoustic transfer function in closely spaced frequency bands, and employs the array starter method to accurately model sound propagation from a spatially distributed source (MacGillivray and Chapman 2012). Ultimately, little difference was observed between the prior sound fields with near-field equivalents computed using MONM versus the current modeling with FWRAM but FWRAM is a more accurate model.

1.7. Vibratory Pile Setting Update

Following the Proposed Rule, the modeling methodology for vibratory pile setting was refined. This January 2024 LOA Update Memo describes the new modeling methodology for vibratory pile setting, which replaces the practical spreading loss approach (that used the NMFS Online User Spreadsheet Tool) described in the Proposed Rule. As described further below, acoustic modeling was completed for vibratory setting of piles followed by impact driving, and exposures were modeled using animal movement modeling. The number of foundations anticipated to require vibratory pile setting is unchanged from the Proposed Rule.

As previously described, during construction of the New England Wind project, it may be necessary to start pile installation using a vibratory hammer rather than using an impact hammer, a technique known as vibratory setting of piles. The vibratory method is particularly useful when seabed sediments are not sufficiently stiff to support the weight of the pile during the initial installation, increasing the risk of 'pile run' where a pile sinks rapidly through seabed sediments. The Proponent conducted a seabed drivability analysis to estimate the number of foundation positions that could potentially require vibratory setting of piles. The analysis suggested that up to 50% of foundations (~66 foundations) could require vibratory setting. An additional 6% conservatism is assumed (6% of 66 is ~4 additional foundations), resulting in approximately 70 total foundations (53% of all proposed foundations) that may require vibratory setting. The number of foundations anticipated to require vibratory pile setting (70) is unchanged from the Proposed Rule and is shown in Tables 2–3.

The Proponent has assessed the potential for impacts to marine fauna (sea turtles, fish, and marine mammals) from vibratory setting and impact pile driving of monopile and jacket foundations during installation, and found impacts to sea turtles, fish, and marine mammals a possibility. Potential impacts to marine mammals, sea turtles, and fish from underwater sound exposure produced by vibratory and impact pile driving during installation could include changes in behavior and auditory injury at distances close to the sound source. A quantitative acoustic assessment was conducted of the potential impacts to marine mammals from vibratory pile setting followed by impact pile driving activity during installation for New England Wind and exposure results are provided in this update. Further details on the modeling methodology and results of this assessment can be found in the Appendix III-M of the COP.

Due to the small size of the PTS ranges and the mitigation that will be applied during construction, no Level A exposures are expected as a result of vibratory pile setting alone. The Project has committed to certain mitigation and monitoring measures which are intended to reduce the risk for Level A take. A pre-clearance and continuous monitoring program throughout pile driving is described in the LOA application and in Section 7. Without any noise attenuation, the largest exposure range expected is approximately 1,100 m for fin whales for the post-piled jacket foundation installation. This is well within the 4,100-m shutdown zone for low frequency cetaceans.

1.8. Fisheries Monitoring Program

The Fisheries Monitoring Program was described in the Proposed Rule and is reproduced here (without additional changes) for completeness.

As previously described, the Proponent has advanced development of a fisheries monitoring program in accordance with the recommendations set forth in the *Guidelines for Providing Information on Fisheries for Renewable Energy Development on the Atlantic Outer Continental Shelf Pursuant to 30 CFR Part 585* (BOEM 2019). The program aims to:

- Identify dominant fish species and their seasonality in the vicinity of the project area;
- Establish a preconstruction baseline;
- Collect additional information intended to reduce uncertainty of the baseline and interpret the results; and
- Develop an approach to quantify any substantial changes to the distribution and abundance of fisheries.

The Proponent's fisheries monitoring program also outlines the general mitigation measures that will be implemented during fisheries monitoring surveys to avoid interactions with marine mammals. Details of the proposed monitoring program are provided d

1.9. Summary Updates to Methodology Related to the Take Request

The following text summarized updates made since the Proposed Rule was issued in June 2023.

- As directed by NMFS, updates were made to guilded species densities for vibratory setting followed by impact pile driving, impact pile driving alone, and drilling.
- New acoustic modeling was completed for drilling, and exposures were calculated by multiplying the zone of influence (ensonified area) by density.
- Acoustic modeling was revised for impact piling and new modeling was conducted for vibratory setting of piles (followed by impact pile driving). Exposures for impact pile driving and vibratory setting were updated using animal movement modeling.

The following tables in this document have been updated and are intended to replace the corresponding density, exposure range, exposure, and take tables included in the Proposed Rule. This January 2024 LOA Update Memo primarily includes tables that have been revised due to the above updates, otherwise tables presented in the July 2022 LOA application and March 2023 LOA Update Memo remain valid. For additional details on the modeling and exposure calculation methodology, please refer to the acoustic modeling report (Appendix III-M of the COP).

2. Density Estimates

The density estimates below were calculated using a perimeter around the area of activity based on the expected zone of influence for each sound-producing activity.

For cases with vibratory setting of piles followed by impact pile driving, and impact pile driving alone, densities were calculated within buffered polygons of various ranges around the Lease Area perimeter. The following ranges were pre-selected: 10, 25, and 50 km. For each species, foundation type, and attenuation level, the most appropriate density perimeter was selected from this list. The range was selected using the 95th percentile exposure range ($ER_{95\%}$) for each case, using the next highest range. For example, if the $ER_{95\%}$ was 8.5 km, the 10 km perimeter would be used. In cases where the $ER_{95\%}$ was larger than 50 km, the 50-km perimeter was used. The 50 km limit is derived from studies of mysticetes that demonstrate received levels, distance from the source, and behavioral context are known to influence the probability of behavioral response (Dunlop et al. 2017). The mean species density for each month was determined by calculating the unweighted mean of all 5 × 5 km grid cells partially or fully within the analysis perimeter (Figure 3). Densities were computed for an entire year and from May to December to coincide with proposed pile driving activities. In cases where monthly densities were unavailable, annual mean densities were used instead.

To calculate marine mammal densities for the potential drilling impact area, it was assumed that the surveys would occur in three areas of interest: J1, M1, and M2. The density perimeter was determined using the longest 10-dB attenuated 95th percentile acoustic range to the behavioral threshold ($R_{95\%}$) for all locations, rounded up to the nearest 5 km, and then applied around the entire lease area (i.e., 7.1 km rounded up to 10 km). Monthly densities were calculated for each species as the average of the densities from all MGEL/Duke model grid cells that overlap partially or completely with the area of interest. Cells entirely on land were not included, but cells that overlap only partially with land were included.

For HRG surveys (Section 2.4), because the range to the Level B threshold is small (<200 m), densities were calculated using the areas of interest without an additional perimeter.

There are two cases in this study for which the MGEL/Duke models report densities for species guilds: seals and pilot whales. For the recently updated modeling efforts- drilling, vibratory setting followed by impact pile driving, and impact pile driving alone, when calculating exposures for individual pilot whale and seal species, the guild densities provided by Roberts et al. (2016a, 2022) were scaled by the relative abundances of the species in each guild, using the best available estimates of local abundance, to get species-specific density estimates surrounding the Lease Area. In estimating local abundances, all distribution data from the two pilot whale species and three seal species were downloaded from the Ocean Biodiversity Information System (OBIS) data repository (available at https://obis.org/). After reviewing the available datasets, it was deemed that data available in OBIS in Rhode Island and Massachusetts waters are the best available for the three seals species because of their overlap with the Lease Area. For seals, OBIS reported 86 observations of gray seals, 129 observations of harbor seals, and 93 observations of harp seals. Therefore, the proportions of 0.28 (86/308), 0.42 (129/308), and 0.30 (93/308) were used to scale the seals guild densities for the three seal species, respectively. The best data available for pilot whales came from AMAPPS data in Rhode Island and Massachusetts waters. The proportions of 0.80 for long-finned and 0.20 for short-finned pilot whales were used (Palka et al. 2021). For previous modeling efforts- UXO detonation, and HRG surveys, for long- and short-finned pilot whales, the guild density from Roberts et al. (2016a, 2022) was scaled by the relative stock sizes based on the best available abundance estimate from NOAA Fisheries SARs (Hayes et al. 2022). Similarly, densities are provided for seals as a guild consisting primarily of harbor and gray seals (Roberts et al. 2016a, 2022). Gray and harbor seal densities were scaled by relative NOAA Fisheries SAR (Hayes et al. 2022) abundance.

2.1. Vibratory Pile Setting Followed by Impact Pile Driving and Impact Pile Driving Only – Densities

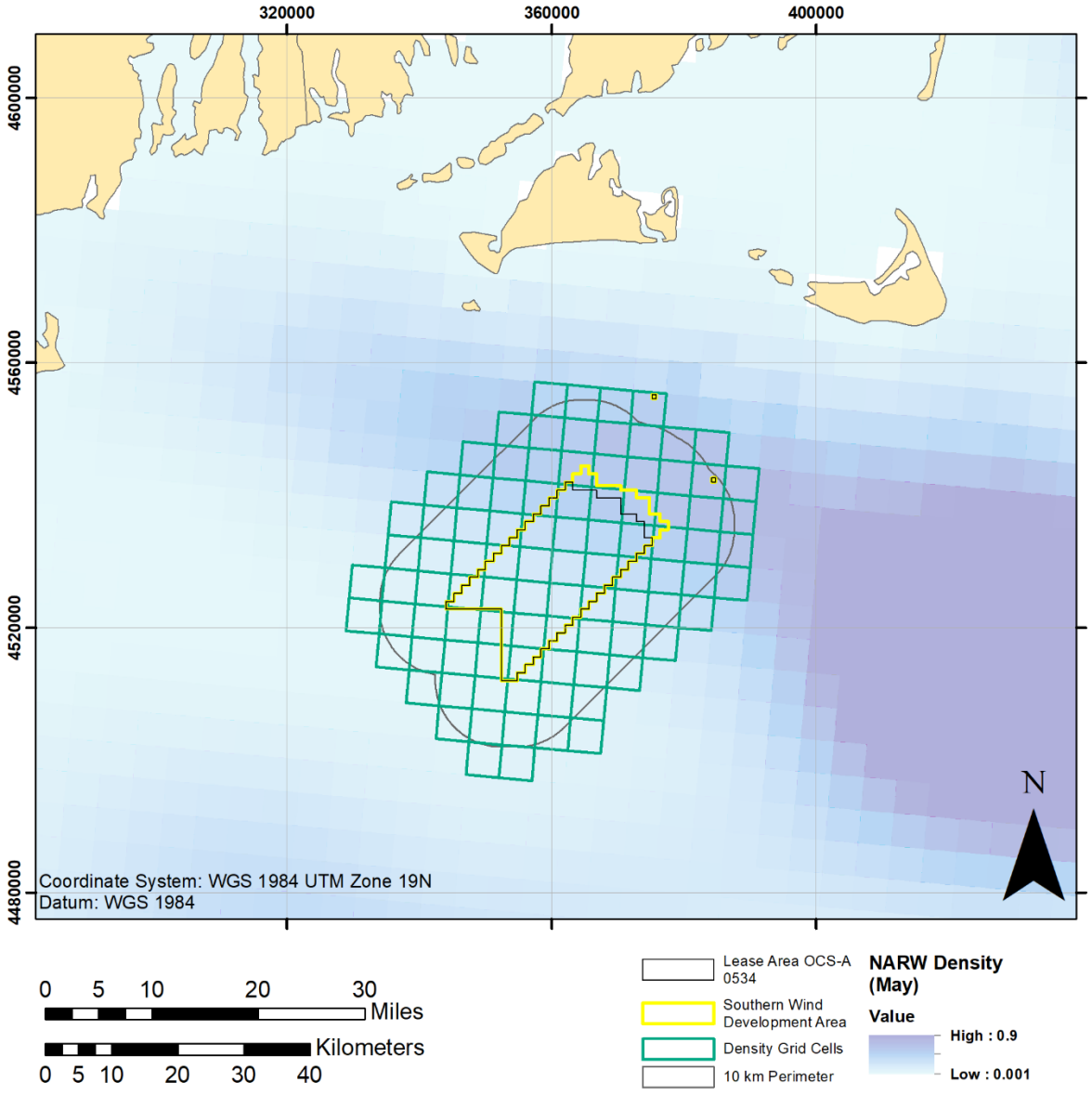

Figure 3. Marine mammal (e.g., NARW) density map (Roberts et al. 2022) showing highlighted grid cells used to calculate mean monthly species density estimates within a 10-km perimeter around New England Wind, the smallest of the selected ranges (10, 25, 50 km), based on acoustic range to the behavioral threshold ($R_{95\%}$) for vibratory pile setting followed by impact pile driving. Note that the modeled densities are in units of animals/100 km^2, even when grid cells are 5 × 5 km.

Table 8. Mean monthly marine mammal density estimates for all modeled species in a 10-km perimeter around New England Wind, used in calculating exposures above threshold criteria for vibratory followed by impact pile driving activities and impact pile driving alone.

Species	Monthly density (animals/100 km^2)												Annual mean	May to Dec mean
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Fin whale [a]	0.215	0.166	0.107	0.164	0.272	0.256	0.438	0.366	0.227	0.057	0.051	0.141	0.205	0.226
Minke whale	0.113	0.137	0.136	0.806	1.728	1.637	0.700	0.471	0.516	0.465	0.052	0.077	0.570	0.706
Humpback whale	0.031	0.023	0.043	0.149	0.294	0.307	0.172	0.120	0.167	0.236	0.190	0.030	0.147	0.189
North Atlantic right whale [a]	0.387	0.461	0.456	0.478	0.295	0.050	0.022	0.018	0.028	0.052	0.068	0.197	0.209	0.091
Sei whale [a]	0.039	0.021	0.044	0.112	0.192	0.052	0.013	0.011	0.019	0.036	0.079	0.065	0.057	0.058
Atlantic white-sided dolphin	2.049	1.230	0.850	1.313	3.322	3.003	1.392	0.730	1.654	2.431	1.791	2.440	1.850	2.095
Atlantic spotted dolphin	0.001	<0.001	<0.001	0.003	0.018	0.025	0.031	0.054	0.273	0.431	0.179	0.018	0.086	0.128
Common dolphin	7.130	2.455	1.884	3.258	6.254	13.905	10.533	14.446	25.703	22.676	11.103	10.774	10.844	14.424
Bottlenose dolphin, offshore	0.495	0.111	0.059	0.156	0.814	1.358	1.479	1.659	1.483	1.337	1.255	1.101	0.942	1.311
Risso's dolphin	0.043	0.004	0.002	0.018	0.096	0.048	0.068	0.128	0.158	0.087	0.120	0.179	0.079	0.111
Long-finned pilot whale [b]	0.189	0.189	0.189	0.189	0.189	0.189	0.189	0.189	0.189	0.189	0.189	0.189	0.189	0.189
Short-finned pilot whale [b]	0.047	0.047	0.047	0.047	0.047	0.047	0.047	0.047	0.047	0.047	0.047	0.047	0.047	0.047
Sperm whale [a]	0.031	0.011	0.013	0.003	0.014	0.028	0.038	0.107	0.070	0.057	0.031	0.020	0.035	0.046
Harbor porpoise	10.007	10.784	10.277	8.914	6.741	0.960	0.880	0.848	0.988	1.271	1.418	5.812	4.908	2.365
Gray seal [b]	5.395	5.603	4.176	3.203	4.716	0.806	0.088	0.094	0.226	0.500	1.768	4.534	2.592	1.591
Harbor seal [b]	8.093	8.404	6.265	4.804	7.074	1.209	0.132	0.140	0.339	0.750	2.652	6.802	3.889	2.387
Harp seal [b]	5.781	6.003	4.475	3.432	5.053	0.864	0.094	0.100	0.242	0.535	1.894	4.858	2.778	1.705

[a] Listed as Endangered under the ESA.
[b] Density adjusted by relative local abundance. Harp seal uses gray seal density.

Table 9. Mean monthly marine mammal density estimates for all modeled species in a 25-km perimeter around New England Wind, used in calculating exposures above threshold criteria for vibratory followed by impact pile driving activities and impact pile driving alone.

Species	Monthly density (animals/100 km^2)												Annual mean	May to Dec mean
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Fin whale [a]	0.213	0.161	0.118	0.165	0.272	0.247	0.391	0.316	0.221	0.068	0.056	0.146	0.198	0.214
Minke whale	0.119	0.138	0.143	0.790	1.617	1.468	0.622	0.397	0.436	0.436	0.054	0.084	0.525	0.639
Humpback whale	0.034	0.026	0.044	0.146	0.271	0.284	0.156	0.107	0.147	0.202	0.174	0.035	0.135	0.172
North Atlantic right whale [a]	0.443	0.523	0.493	0.471	0.279	0.052	0.026	0.019	0.029	0.050	0.084	0.257	0.227	0.100
Sei whale [a]	0.036	0.022	0.045	0.115	0.186	0.053	0.013	0.010	0.017	0.035	0.080	0.066	0.056	0.058
Atlantic white-sided dolphin	2.062	1.314	0.913	1.383	3.179	2.994	1.368	0.644	1.532	2.246	1.741	2.357	1.811	2.008
Atlantic spotted dolphin	0.001	<0.001	<0.001	0.003	0.027	0.042	0.034	0.055	0.282	0.577	0.181	0.020	0.102	0.152
Common dolphin	7.388	2.799	2.212	3.612	6.556	13.827	10.602	13.820	23.538	24.395	12.882	11.716	11.112	14.667
Bottlenose dolphin, offshore	0.476	0.118	0.066	0.174	0.835	1.390	1.491	1.624	1.528	1.414	1.324	1.077	0.960	1.335
Risso's dolphin	0.051	0.006	0.003	0.021	0.112	0.070	0.092	0.170	0.223	0.122	0.128	0.174	0.098	0.136
Long-finned pilot whale [b]	0.188	0.188	0.188	0.188	0.188	0.188	0.188	0.188	0.188	0.188	0.188	0.188	0.188	0.188
Short-finned pilot whale [b]	0.047	0.047	0.047	0.047	0.047	0.047	0.047	0.047	0.047	0.047	0.047	0.047	0.047	0.047
Sperm whale [a]	0.030	0.012	0.012	0.003	0.013	0.028	0.038	0.115	0.059	0.042	0.029	0.021	0.034	0.043
Harbor porpoise	9.007	9.787	9.321	8.194	5.913	1.172	1.147	1.030	1.003	1.222	1.421	5.478	4.558	2.298
Gray seal [b]	5.553	5.401	3.946	3.485	5.109	1.750	0.315	0.296	0.497	0.881	2.108	4.485	2.819	1.930
Harbor seal [b]	8.329	8.101	5.919	5.227	7.664	2.625	0.473	0.443	0.745	1.322	3.161	6.728	4.228	2.895
Harp seal [b]	5.949	5.786	4.228	3.733	5.474	1.875	0.338	0.317	0.532	0.944	2.258	4.806	3.020	2.068

[a] Listed as Endangered under the ESA.
[b] Density adjusted by relative local abundance. Harp seal uses gray seal density.

Table 10. Mean monthly marine mammal density estimates for all modeled species in a 50-km perimeter around New England Wind, used in calculating exposures above threshold criteria for vibratory followed by impact pile driving activities and impact pile driving alone.

Species	Monthly density (animals/100 km^2)												Annual mean	May to Dec mean
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Fin whale [a]	0.194	0.158	0.142	0.169	0.256	0.246	0.383	0.316	0.244	0.093	0.060	0.128	0.199	0.216
Minke whale	0.106	0.121	0.138	0.652	1.298	1.163	0.504	0.302	0.338	0.387	0.051	0.080	0.428	0.515
Humpback whale	0.037	0.030	0.044	0.167	0.270	0.300	0.158	0.096	0.124	0.177	0.164	0.041	0.134	0.166
North Atlantic right whale [a]	0.565	0.674	0.580	0.511	0.321	0.084	0.055	0.033	0.045	0.055	0.119	0.361	0.284	0.134
Sei whale [a]	0.030	0.024	0.045	0.123	0.181	0.059	0.016	0.009	0.014	0.034	0.076	0.058	0.056	0.056
Atlantic white-sided dolphin	2.430	1.744	1.187	1.652	3.170	3.373	1.468	0.508	1.265	2.153	1.732	2.428	1.926	2.012
Atlantic spotted dolphin	0.002	<0.001	<0.001	0.006	0.073	0.182	0.052	0.084	0.449	1.025	0.238	0.027	0.178	0.266
Common dolphin	10.202	5.127	4.047	5.422	8.950	18.237	13.103	14.754	22.465	30.637	18.664	15.127	13.895	17.742
Bottlenose dolphin, offshore	0.691	0.222	0.130	0.293	1.119	1.863	1.924	1.935	2.001	1.972	1.905	1.455	1.293	1.772
Risso's dolphin	0.110	0.023	0.009	0.040	0.230	0.227	0.299	0.488	0.642	0.322	0.190	0.218	0.233	0.327
Long-finned pilot whale [b]	0.231	0.231	0.231	0.231	0.231	0.231	0.231	0.231	0.231	0.231	0.231	0.231	0.231	0.231
Short-finned pilot whale [b]	0.058	0.058	0.058	0.058	0.058	0.058	0.058	0.058	0.058	0.058	0.058	0.058	0.058	0.058
Sperm whale [a]	0.031	0.018	0.018	0.005	0.014	0.029	0.039	0.111	0.053	0.035	0.028	0.028	0.034	0.042
Harbor porpoise	6.731	7.481	7.192	6.632	4.590	1.481	1.388	1.038	0.852	1.130	1.383	4.273	3.681	2.017
Gray seal [b]	5.346	4.893	4.081	4.674	6.820	5.412	1.595	1.318	1.519	2.863	3.322	4.748	3.882	3.450
Harbor seal [b]	8.019	7.339	6.121	7.011	10.229	8.118	2.392	1.977	2.279	4.295	4.982	7.122	5.824	5.174
Harp seal [b]	5.728	5.242	4.372	5.008	7.307	5.798	1.709	1.412	1.628	3.068	3.559	5.087	4.160	3.696

[a] Listed as Endangered under the ESA.
[b] Density adjusted by relative local abundance. Harp seal uses gray seal density.

2.2. Drilling – Densities

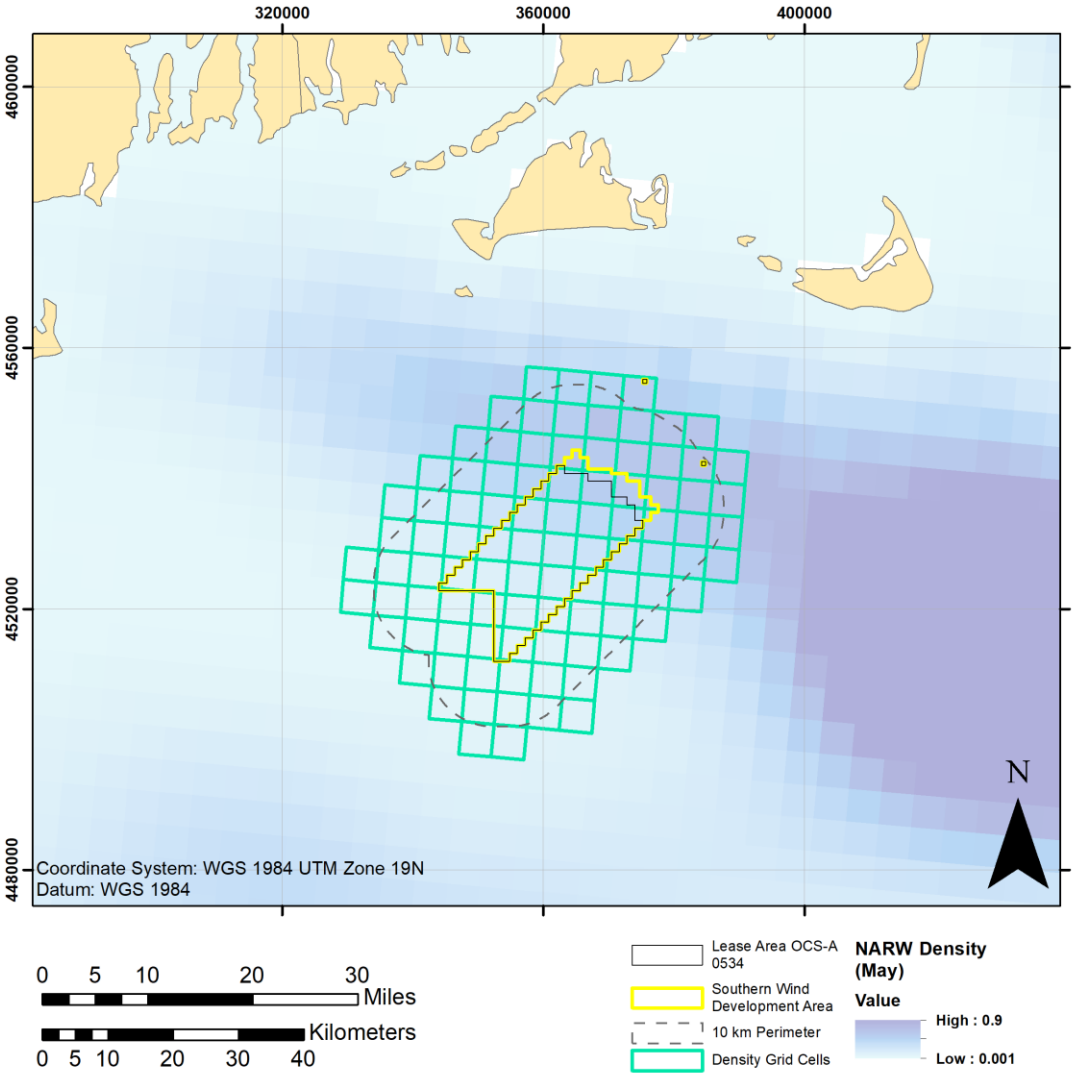

Figure 4. Marine mammal (e.g., NARW) density map (Roberts et al. 2022) showing highlighted grid cells used to calculate mean monthly species density estimates within a 10 km perimeter around New England Wind, used to estimate exposures to drilling sounds above the 120 dB SPL criterion. Note that the modeled densities are in units of animals/100 km^2, even when grid cells are 5 × 5 km.

Table 11. Mean monthly marine mammal density estimates for all modeled species in a 10-km perimeter around New England Wind, used to calculate exposures above the 120 dB SPL behavioral threshold for drilling sounds.

Species	Monthly density (animals/100 km^2)												Annual mean	May to Dec mean
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Fin whale [a]	0.215	0.166	0.107	0.164	0.272	0.256	0.438	0.366	0.227	0.057	0.051	0.141	0.205	0.226
Minke whale	0.113	0.137	0.136	0.806	1.728	1.637	0.700	0.471	0.516	0.465	0.052	0.077	0.570	0.706
Humpback whale	0.031	0.023	0.043	0.149	0.294	0.307	0.172	0.120	0.167	0.236	0.190	0.030	0.147	0.189
North Atlantic right whale [a]	0.387	0.461	0.456	0.478	0.295	0.050	0.022	0.018	0.028	0.052	0.068	0.197	0.209	0.091
Sei whale [a]	0.039	0.021	0.044	0.112	0.192	0.052	0.013	0.011	0.019	0.036	0.079	0.065	0.057	0.058
Atlantic white-sided dolphin	2.049	1.230	0.850	1.313	3.322	3.003	1.392	0.730	1.654	2.431	1.791	2.440	1.850	2.095
Atlantic spotted dolphin	0.001	0.000	0.001	0.003	0.018	0.025	0.031	0.054	0.273	0.431	0.179	0.018	0.086	0.128
Common dolphin	7.130	2.455	1.884	3.258	6.254	13.905	10.533	14.446	25.703	22.676	11.103	10.774	10.844	14.424
Bottlenose dolphin, offshore	0.495	0.111	0.059	0.156	0.814	1.358	1.479	1.659	1.483	1.337	1.255	1.101	0.942	1.311
Risso's dolphin	0.043	0.004	0.002	0.018	0.096	0.048	0.068	0.128	0.158	0.087	0.120	0.179	0.079	0.111
Long-finned pilot whale [b]	0.189	0.189	0.189	0.189	0.189	0.189	0.189	0.189	0.189	0.189	0.189	0.189	0.189	0.189
Short-finned pilot whale [b]	0.047	0.047	0.047	0.047	0.047	0.047	0.047	0.047	0.047	0.047	0.047	0.047	0.047	0.047
Sperm whale [a]	0.031	0.011	0.013	0.003	0.014	0.028	0.038	0.107	0.070	0.057	0.031	0.020	0.035	0.046
Harbor porpoise	10.007	10.784	10.277	8.914	6.741	0.960	0.880	0.848	0.988	1.271	1.418	5.812	4.908	2.365
Gray seal [b]	5.395	5.603	4.176	3.203	4.716	0.806	0.088	0.094	0.226	0.500	1.768	4.534	2.592	1.591
Harbor seal [b]	8.093	8.404	6.265	4.804	7.074	1.209	0.132	0.140	0.339	0.750	2.652	6.802	3.889	2.387
Harp seal [b]	5.781	6.003	4.475	3.432	5.053	0.864	0.094	0.100	0.242	0.535	1.894	4.858	2.778	1.705

[a] Listed as Endangered under the ESA.
[b] Density adjusted by relative abundance. Harp seal uses gray seal density.

2.3. Potential UXO Detonation – Densities

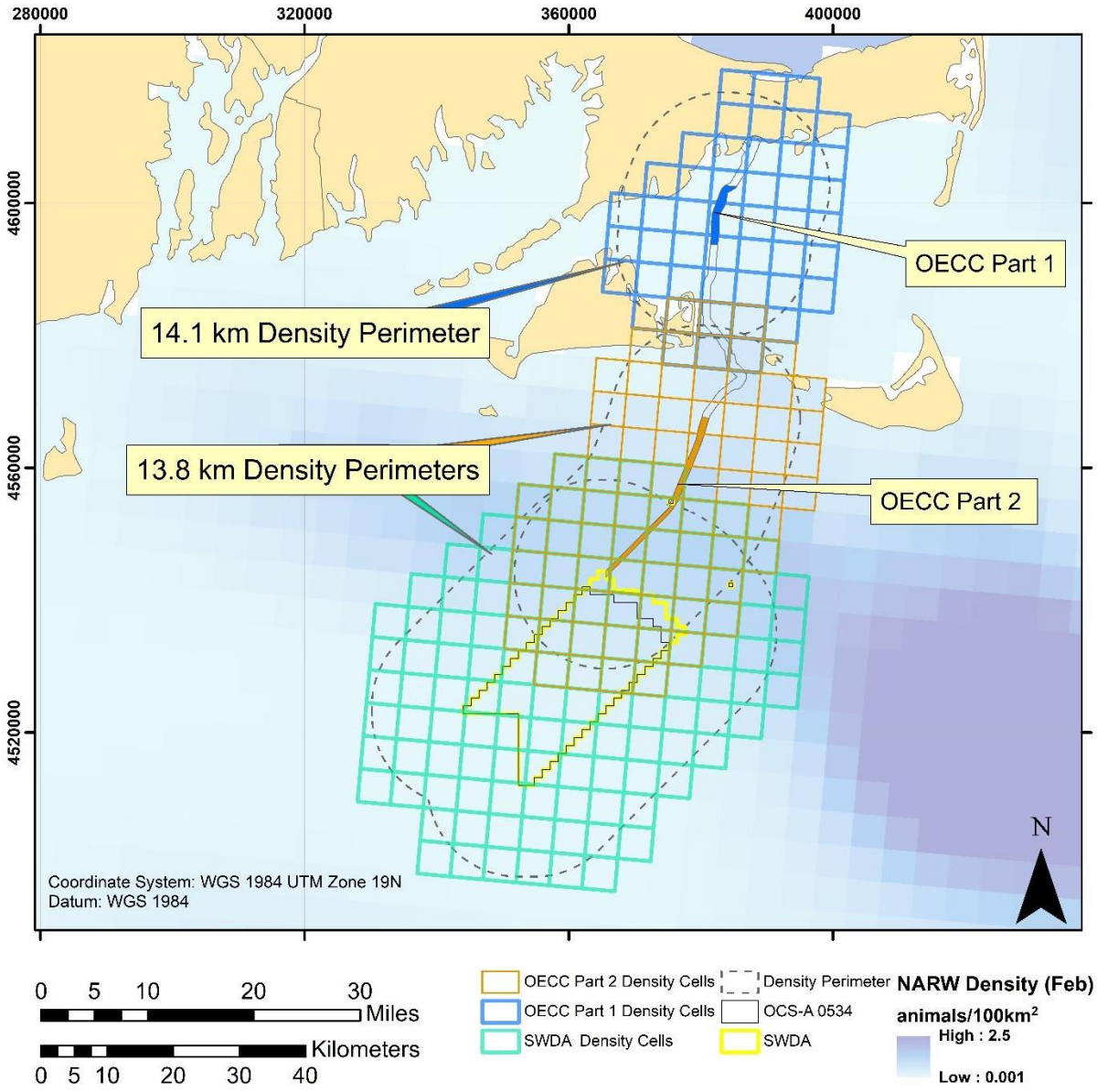

Figure 5. Marine mammal (e.g., NARW) density map (Roberts et al. 2022) showing highlighted grid cells used to calculate mean monthly species density estimates within a 13.8 km (OECC Part 2) and 14.1 km (OECC Part 1) perimeter around New England Wind's Offshore Export Cable Corridors (OECCs), used to estimate exposures to detonation sounds above the US Navy's TTS criterion by SEL (Finneran et al. 2017). Note that the modeled densities are in units of animals/100 km^2, even when grid cells are 5 × 5 km.

Table 12. Maximum monthly density (animals/100 km^2) at the moderate UXO risk areas used to estimate exposures during potential UXO detonations for New England Wind.

Species	Maximum monthly density (animals/100 km^2)	
	Shallow OECC Segment (OECC Part 1)	Deep OECC Segment (OECC Part 2) and SWDA
Fin whale [a]	0.007	0.425
Minke whale	0.129	1.720
Humpback whale	0.040	0.297
North Atlantic right whale [a]	0.116	0.707
Sei whale [a]	0.034	0.191
Atlantic white-sided dolphin	0.051	3.278
Atlantic spotted dolphin	0.013	0.448
Common dolphin	0.350	24.845
Bottlenose dolphin, offshore	0.158	1.631
Risso's dolphin	0.010	0.176
Long-finned pilot whale [b]	0.000	0.135
Short-finned pilot whale [b]	0.000	0.100
Sperm whale [a]	0.002	0.112
Harbor porpoise	1.772	10.608
Gray seal [b]	24.506	13.647
Harbor seal [b]	55.059	30.662
Harp seal [b]	24.506	13.647

[a] Listed as Endangered under the ESA.
[b] Long- and short-finned pilot whale densities are the annual pilot whale guild density scaled by their relative abundances.
[c] Gray and harbor seal densities are the seals guild density scaled by their relative abundances; gray seals are used as a surrogate for harp seals.

2.4. HRG Surveys – Densities

LOA Marine mammal densities (Table 13) for the potential HRG survey were calculated assuming that the surveys would occur in four areas of interest (see Figure 6):

1. Phase 2 South Coast Variant Offshore Routing Envelope,
2. New England Wind Offshore Export Cable Corridor (OECC),
3. Phase 2 OECC Western Muskeget Variant, and
4. Maximum size of the Southern Wind Development Area.

Table 13. Maximum monthly density (animals/100 km^2) used to estimate exposures above acoustic thresholds during HRG surveys for New England Wind.

Species	Maximum monthly density (animals/100 km^2)
Fin whale [a]	0.436
Minke whale	1.704
Humpback whale	0.323
North Atlantic right whale [a,]	0.567
Sei whale [a]	0.193
Atlantic white-sided dolphin	3.406
Atlantic spotted dolphin	0.404
Common dolphin	28.314
Bottlenose dolphin, offshore	1.753
Risso's dolphin	0.187
Long-finned pilot whale [b]	0.149
Short-finned pilot whale [b]	0.110
Sperm whale [a]	0.111
Harbor porpoise	10.974
Gray seal [c]	27.901
Harbor seal [c]	62.687
Harp seal [c]	27.901

[a] Listed as Endangered under the ESA.
[b] Long- and short-finned pilot whale densities are the annual pilot whale guild density scaled by their relative abundances.
[c] Gray and harbor seal densities are the seals guild density scaled by their relative abundances; gray seals are used as a surrogate for harp seals.

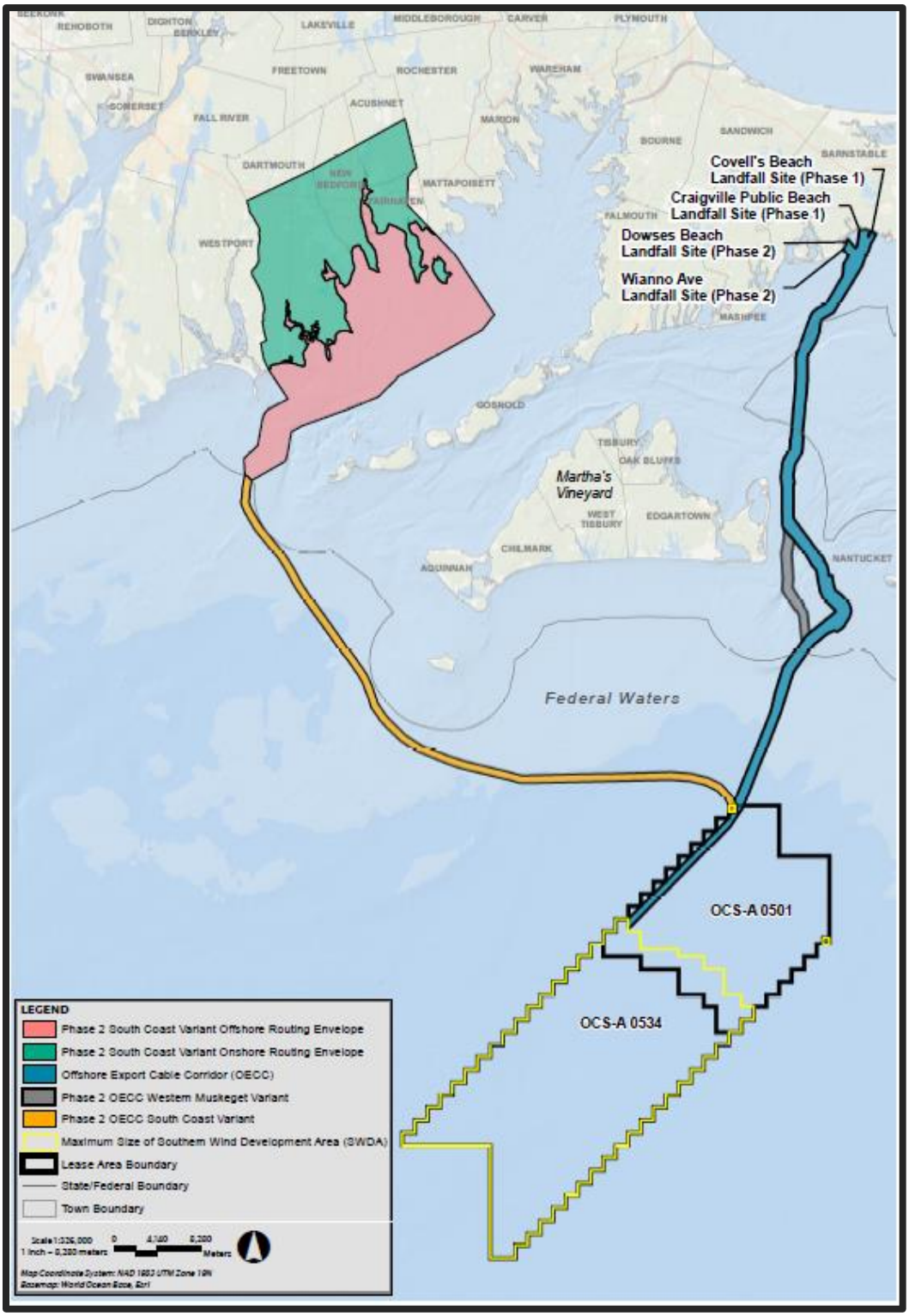

Figure 6. Map showing two potential Phase 2 offshore export cable variants. The four areas of interest used in the HRG survey exposure calculations are: 1) Phase 2 South Coast Variant Offshore Routing Envelope, 2) New England Wind Offshore Export Cable Corridor (OECC), 3) Phase 2 OECC Western Muskeget Variant, and 4) Maximum size of the Southern Wind Development Area.

3. Range Estimates

3.1. Impact Pile Driving Only – Exposure Ranges

Exposure ranges, or $ER_{95\%}$, are the horizontal distances that include 95% of the CPAs of animats exceeding a given impact threshold calculated for marine mammals. This section includes results for each of the modeled foundation types installed with impact pile driving only, assuming 0-, 10-, and 12-dB broadband attenuation. It is noted that there is little difference between the estimates for one pile per day and two piles per day, and there are instances of exposure range predictions for two piles per day being shorter than the predictions for one pile per day. The reason is that the distance between piles when driving two in a day is great enough that there is little or no overlap in the area affected so the range estimates are approximately the same for one pile per day versus two piles per day. Because the underlying model is statistical in nature, multiple runs of the same scenario differ slightly. In this case, the exposure ranges for two piles per may be smaller than for one pile per day because of the stochastic nature of the model.

Table 14. 12 m monopile, 5000 kJ hammer, one pile per day: Exposure ranges ($ER_{95\%}$) in km to marine mammal threshold criteria with sound attenuation.

Species		Injury						Behavior					
		L_E			L_{pk}			L_p a			L_p b		
		Attenuation (dB)						Attenuation (dB)					
		0	10	12	0	10	12	0	10	12	0	10	12
LF	Fin whale [c]	4.92	2.00	1.75	0.03	<0.01	<0.01	9.97	4.88	4.26	9.97	4.86	4.23
	Minke whale	2.92	0.82	0.69	0	0	0	9.33	4.61	3.80	26.28	16.51	14.58
	Humpback whale	4.32	1.71	1.21	0	0	0	9.87	4.86	4.10	9.85	4.78	4.10
	North Atlantic right whale [c]	3.50	1.19	0.96	<0.01	0	0	9.04	4.50	3.60	9.07	4.47	3.60
	Sei whale [c]	3.42	0.94	0.62	0	0	0	9.70	4.72	3.94	27.88	17.26	15.61
MF	Atlantic white-sided dolphin	0	0	0	<0.01	0	0	8.99	4.26	3.60	4.05	1.71	1.32
	Atlantic spotted dolphin	0	0	0	0	0	0	9.21	4.48	3.36	4.36	1.87	1.42
	Short-beaked common dolphin	0	0	0	0	0	0	9.15	4.47	3.80	4.03	1.79	1.50
	Bottlenose dolphin	0	0	0	0	0	0	8.18	3.98	3.32	3.65	1.39	1.10
	Risso's dolphin	0	0	0	0	0	0	8.59	4.30	3.55	4.15	1.63	1.26
	Long-finned pilot whale	0	0	0	0	0	0	8.95	4.20	3.45	3.93	1.59	1.36
	Short-finned pilot whale	0	0	0	0	0	0	0	0	0	0	0	0
	Sperm whale [c]	0	0	0	0	0	0	9.42	4.68	4.00	4.26	1.79	1.49
HF	Harbor porpoise	0	0	0	0.40	<0.01	<0.01	8.02	4.23	3.44	32.80	20.61	18.79
PPW	Gray seal	0.51	0	0	0	0	0	10.37	5.10	4.51	7.25	3.46	2.91
	Harbor seal	0.27	0	0	0.02	0	0	8.69	3.80	3.26	5.76	2.78	2.40
	Harp seal	0.42	0	0	0.02	0	0	9.59	4.86	4.28	6.88	3.14	2.72

[a] NOAA (2005), b Wood et al. (2012), c Listed as Endangered under the ESA.

Table 15. 12 m monopile, 5000 kJ hammer, two piles per day: Exposure ranges ($ER_{95\%}$) in km to marine mammal threshold criteria with sound attenuation.

Species		Injury						Behavior					
		L_E			L_{pk}			L_p a			L_p b		
		Attenuation (dB)						Attenuation (dB)					
		0	10	12	0	10	12	0	10	12	0	10	12
LF	Fin whale [c]	5.35	2.13	1.85	0.03	0	0	9.83	4.92	4.12	9.86	4.82	4.13
	Minke whale	2.96	0.96	0.72	0	0	0	9.29	4.32	3.69	26.05	16.18	14.51
	Humpback whale	4.84	1.78	1.31	0.06	0	0	9.62	4.65	3.94	9.64	4.60	3.93
	North Atlantic right whale [c]	3.79	1.41	0.97	0.02	0	0	9.07	4.39	3.80	9.17	4.36	3.79
	Sei whale [c]	3.37	1.14	0.74	0.02	0	0	9.33	4.60	3.94	27.97	16.76	15.18
MF	Atlantic white-sided dolphin	0	0	0	0	0	0	8.91	4.31	3.60	4.11	1.69	1.33
	Atlantic spotted dolphin	0	0	0	0	0	0	9.22	4.18	3.49	3.91	1.75	1.40
	Short-beaked common dolphin	0	0	0	<0.01	0	0	8.97	4.34	3.67	3.99	1.70	1.43
	Bottlenose dolphin	0	0	0	0	0	0	7.91	3.79	3.22	3.50	1.45	1.26
	Risso's dolphin	0	0	0	0	0	0	8.58	4.20	3.57	3.99	1.74	1.49
	Long-finned pilot whale	0	0	0	0	0	0	8.65	4.09	3.43	3.93	1.60	1.35
	Short-finned pilot whale	0	0	0	0	0	0	0	0	0	0	0	0
	Sperm whale [c]	0	0	0	0	0	0	9.34	4.51	3.89	4.24	1.88	1.56
HF	Harbor porpoise	0	0	0	0.44	0.21	<0.01	7.89	3.94	3.38	32.51	20.67	18.90
PPW	Gray seal	0.65	0	0	0	0	0	10.22	5.13	4.41	7.29	3.39	2.99
	Harbor seal	0.33	0	0	0.03	0	0	8.69	4.06	3.32	5.77	2.73	2.21
	Harp seal	0.42	0	0	0.07	0	0	9.66	4.84	4.16	6.71	3.13	2.57

[a] NOAA (2005), [b] Wood et al. (2012), [c] Listed as Endangered under the ESA.

Table 16. 12 m monopile, 6000 kJ hammer, one pile per day: Exposure ranges ($ER_{95\%}$) in km to marine mammal threshold criteria with sound attenuation.

Species		Injury						Behavior					
		L_E			L_{pk}			L_p a			L_p b		
		Attenuation (dB)						Attenuation (dB)					
		0	10	12	0	10	12	0	10	12	0	10	12
LF	Fin whale [c]	5.03	2.05	1.87	0.05	<0.01	<0.01	10.47	5.28	4.54	10.49	5.27	4.54
	Minke whale	3.13	0.91	0.82	0	0	0	9.98	4.95	4.22	27.76	17.27	15.63
	Humpback whale	4.68	1.72	1.41	0.02	0	0	10.39	5.26	4.52	10.46	5.23	4.49
	North Atlantic right whale [c]	3.87	1.19	0.99	<0.01	0	0	9.82	4.91	4.16	9.87	5.00	4.11
	Sei whale [c]	3.62	1.36	0.81	0	0	0	10.43	5.19	4.25	29.15	18.72	16.58
MF	Atlantic white-sided dolphin	0	0	0	<0.01	0	0	9.78	4.87	4.16	4.59	1.90	1.55
	Atlantic spotted dolphin	0	0	0	<0.01	0	0	10.19	5.02	4.16	4.83	2.00	1.59
	Short-beaked common dolphin	0	0	0	<0.01	0	0	9.94	4.99	4.20	4.56	2.00	1.72
	Bottlenose dolphin	0	0	0	0	0	0	9.03	4.45	3.56	3.98	1.92	1.55
	Risso's dolphin	0	0	0	0	0	0	9.53	4.72	4.00	4.53	2.02	1.55
	Long-finned pilot whale	0	0	0	0	0	0	9.68	4.75	4.01	4.45	1.84	1.56
	Short-finned pilot whale	0	0	0	0	0	0	0	0	0	0	0	0
	Sperm whale [c]	0	0	0	0	0	0	9.95	5.22	4.29	4.68	2.09	1.69
HF	Harbor porpoise	0	0	0	0.57	0.20	<0.01	8.70	4.46	3.77	34.68	21.85	19.75
PPW	Gray seal	0.51	0	0	0	0	0	10.86	5.58	4.74	7.58	3.73	3.10
	Harbor seal	0.40	0	0	0.02	0	0	9.24	4.45	3.77	6.44	2.97	2.60
	Harp seal	0.32	0	0	<0.01	0	0	10.38	5.26	4.41	7.44	3.48	2.95

[a] NOAA (2005), [b] Wood et al. (2012), [c] Listed as Endangered under the ESA.

Table 17. 12 m monopile, 6000 kJ hammer, two piles per day: Exposure ranges ($ER_{95\%}$) in km to marine mammal threshold criteria with sound attenuation.

Species		Injury						Behavior					
		L_E			L_{pk}			L_p [a]			L_p [b]		
		Attenuation (dB)						Attenuation (dB)					
		0	10	12	0	10	12	0	10	12	0	10	12
LF	Fin whale [c]	5.43	2.16	1.87	0.06	0	0	10.43	5.29	4.39	10.48	5.31	4.35
	Minke whale	3.19	1.12	0.68	0	0	0	9.90	4.87	4.13	27.68	17.36	15.52
	Humpback whale	4.91	1.97	1.42	0.06	0	0	10.27	5.12	4.32	10.32	5.17	4.32
	North Atlantic right whale [c]	3.88	1.34	1.17	0.02	0	0	9.75	4.83	4.23	9.81	4.81	4.26
	Sei whale [c]	3.61	1.27	0.73	0.05	0	0	10.18	5.17	4.36	29.39	18.19	16.26
MF	Atlantic white-sided dolphin	0	0	0	0	0	0	9.66	4.83	4.07	4.49	1.94	1.63
	Atlantic spotted dolphin	0	0	0	0	0	0	10.04	4.51	4.08	4.38	2.07	1.65
	Short-beaked common dolphin	0	0	0	<0.01	0	0	9.67	4.88	4.08	4.54	2.00	1.71
	Bottlenose dolphin	0	0	0	0	0	0	8.83	4.18	3.42	3.84	1.78	1.53
	Risso's dolphin	0	0	0	<0.01	0	0	9.28	4.74	4.04	4.44	1.98	1.68
	Long-finned pilot whale	0	0	0	0	0	0	9.56	4.72	3.88	4.38	1.84	1.55
	Short-finned pilot whale	0	0	0	0	0	0	0	0	0	0	0	0
	Sperm whale [c]	0	0	0	0	0	0	9.96	5.16	4.23	4.76	2.08	1.75
HF	Harbor porpoise	0	0	0	0.49	0.12	<0.01	8.43	4.44	3.68	34.20	21.94	19.92
PPW	Gray seal	0.69	0	0	0	0	0	10.67	5.53	4.70	7.82	3.72	3.16
	Harbor seal	0.35	0	0	<0.01	0	0	9.11	4.41	3.69	6.34	2.96	2.57
	Harp seal	0.53	0	0	0.06	0	0	10.36	5.31	4.38	7.19	3.45	2.85

[a] NOAA (2005), [b] Wood et al. (2012), [c] Listed as Endangered under the ESA.

Table 18. 13 m monopile, 5000 kJ hammer, one pile per day: Exposure ranges ($ER_{95\%}$) in km to marine mammal threshold criteria with sound attenuation.

Species		Injury						Behavior					
		L_E			L_{pk}			L_p [a]			L_p [b]		
		Attenuation (dB)						Attenuation (dB)					
		0	10	12	0	10	12	0	10	12	0	10	12
LF	Fin whale [c]	5.38	2.04	1.81	0.02	0	0	10.61	5.08	4.31	10.59	5.09	4.29
	Minke whale	3.58	0.96	0.85	0	0	0	9.56	4.44	4.05	32.50	18.41	16.36
	Humpback whale	4.91	1.87	1.44	0.05	0	0	10.29	5.02	4.34	10.31	5.07	4.21
	North Atlantic right whale [c]	3.98	1.19	1.04	0.01	0	0	9.65	4.73	4.10	9.71	4.73	4.09
	Sei whale [c]	3.73	1.17	0.95	0	0	0	10.42	4.96	4.20	34.88	19.90	17.74
MF	Atlantic white-sided dolphin	0	0	0	0	0	0	9.40	4.50	4.02	4.22	1.83	1.44
	Atlantic spotted dolphin	0	0	0	0	0	0	9.63	4.74	3.92	4.45	2.15	1.42
	Short-beaked common dolphin	0	0	0	<0.01	0	0	9.56	4.63	3.92	4.26	1.94	1.52
	Bottlenose dolphin	0	0	0	0	0	0	8.83	4.09	3.32	3.55	1.64	1.32
	Risso's dolphin	0	0	0	0	0	0	9.05	4.55	3.99	4.27	1.95	1.50
	Long-finned pilot whale	0	0	0	0	0	0	9.05	4.39	3.86	4.09	1.90	1.49
	Short-finned pilot whale	0	0	0	0	0	0	0	0	0	0	0	0
	Sperm whale [c]	0	0	0	0	0	0	10.04	4.80	4.22	4.41	2.00	1.63
HF	Harbor porpoise	0	0	0	0.54	0.21	0	8.45	4.49	3.77	37.04	21.58	19.43
PPW	Gray seal	0.71	0	0	0	0	0	10.70	5.42	4.69	7.30	3.70	3.09
	Harbor seal	0.31	0	0	0	0	0	8.99	4.33	3.55	5.98	3.01	2.37
	Harp seal	0.30	0	0	0.06	0	0	10.32	5.02	4.38	6.81	3.29	2.92

[a] NOAA (2005), [b] Wood et al. (2012), [c] Listed as Endangered under the ESA.

Table 19. 13 m monopile, 5000 kJ hammer, two piles per day: Exposure ranges ($ER_{95\%}$) in km to marine mammal threshold criteria with sound attenuation.

Species		Injury						Behavior					
		L_E			L_{pk}			L_p [a]			L_p [b]		
		Attenuation (dB)						Attenuation (dB)					
		0	10	12	0	10	12	0	10	12	0	10	12
LF	Fin whale [c]	5.75	2.30	1.91	0.02	0	0	10.35	4.99	4.33	10.38	4.99	4.29
	Minke whale	3.45	1.02	0.67	0.02	0	0	9.58	4.67	4.08	32.60	18.45	16.05
	Humpback whale	5.03	1.99	1.48	0.05	<0.01	<0.01	10.21	4.93	4.39	10.25	4.94	4.26
	North Atlantic right whale [c]	3.95	1.37	1.11	0	0	0	9.55	4.51	3.83	9.67	4.49	3.83
	Sei whale [c]	3.71	1.30	1.23	0	0	0	10.25	4.90	4.32	33.44	19.77	17.12
MF	Atlantic white-sided dolphin	0	0	0	0	0	0	9.29	4.47	3.89	4.22	1.67	1.39
	Atlantic spotted dolphin	0	0	0	0	0	0	9.60	4.58	3.89	4.27	1.99	1.54
	Short-beaked common dolphin	0	0	0	<0.01	0	0	9.48	4.55	3.99	4.25	1.83	1.48
	Bottlenose dolphin	0	0	0	0	0	0	8.47	4.12	3.41	3.54	1.64	1.24
	Risso's dolphin	0	0	0	0	0	0	9.03	4.50	3.98	4.22	1.89	1.42
	Long-finned pilot whale	0	0	0	<0.01	0	0	9.11	4.38	3.77	4.14	1.79	1.47
	Short-finned pilot whale	0	0	0	0	0	0	0	0	0	0	0	0
	Sperm whale [c]	0	0	0	0	0	0	9.78	4.84	4.03	4.32	2.02	1.64
HF	Harbor porpoise	0.04	0	0	0.58	0.24	0.03	8.21	4.41	3.76	37.44	21.68	19.43
PPW	Gray seal	0.65	0	0	0	0	0	10.66	5.34	4.63	7.27	3.73	3.05
	Harbor seal	0.43	0	0	<0.01	<0.01	0	8.68	4.18	3.49	5.85	3.02	2.60
	Harp seal	0.55	0	0	0.05	0	0	10.29	4.96	4.35	6.89	3.27	2.89

[a] NOAA (2005), [b] Wood et al. (2012), [c] Listed as Endangered under the ESA.

Table 20. 13 m monopile, 6000 kJ hammer, one pile per day: Exposure ranges ($ER_{95\%}$) in km to marine mammal threshold criteria with sound attenuation.

Species		Injury						Behavior					
		L_E			L_{pk}			L_p [a]			L_p [b]		
		Attenuation (dB)						Attenuation (dB)					
		0	10	12	0	10	12	0	10	12	0	10	12
LF	Fin whale [c]	5.68	2.14	1.90	0.03	0	0	11.23	5.56	4.88	11.29	5.50	4.85
	Minke whale	3.75	1.22	0.88	0	0	0	10.57	5.05	4.41	34.43	19.93	17.60
	Humpback whale	4.96	1.96	1.52	0.06	0	0	10.99	5.27	4.70	11.01	5.24	4.68
	North Atlantic right whale [c]	4.17	1.56	1.10	0.02	0	0	10.52	5.28	4.34	10.55	5.19	4.34
	Sei whale [c]	4.07	1.32	0.89	0.04	0	0	11.12	5.44	4.48	36.73	20.99	19.05
MF	Atlantic white-sided dolphin	0	0	0	0	0	0	10.35	5.01	4.27	4.51	2.05	1.65
	Atlantic spotted dolphin	0	0	0	0	0	0	10.62	4.88	4.40	4.70	2.26	1.99
	Short-beaked common dolphin	0	0	0	<0.01	0	0	10.47	5.28	4.36	4.74	2.02	1.63
	Bottlenose dolphin	0	0	0	0	0	0	9.73	4.70	3.93	4.08	1.78	1.51
	Risso's dolphin	0	0	0	<0.01	0	0	9.82	4.93	4.27	4.65	2.04	1.76
	Long-finned pilot whale	0	0	0	0	0	0	10.04	4.95	4.14	4.62	2.05	1.62
	Short-finned pilot whale	0	0	0	0	0	0	0	0	0	0	0	0
	Sperm whale [c]	0	0	0	0	0	0	10.79	5.33	4.61	4.77	2.14	1.83
HF	Harbor porpoise	0	0	0	0.57	0.20	<0.01	8.99	4.74	4.08	38.84	22.87	20.72
PPW	Gray seal	0.72	0	0	0	0	0	11.35	5.85	4.88	7.75	3.81	3.42
	Harbor seal	0.37	0	0	0	0	0	9.55	4.43	4.02	6.30	3.30	2.84
	Harp seal	0.57	0	0	0.06	0	0	10.89	5.50	4.70	7.48	3.60	3.15

[a] NOAA (2005), [b] Wood et al. (2012), [c] Listed as Endangered under the ESA.

Table 21. 13 m monopile, 6000 kJ hammer, two piles per day: Exposure ranges ($ER_{95\%}$) in km to marine mammal threshold criteria with sound attenuation.

Species		Injury						Behavior					
		L_E			L_{pk}			L_p [a]			L_p [b]		
		Attenuation (dB)						Attenuation (dB)					
		0	10	12	0	10	12	0	10	12	0	10	12
LF	Fin whale [c]	5.96	2.58	2.04	0.06	0	0	11.04	5.40	4.70	11.08	5.40	4.70
	Minke whale	3.64	1.19	0.96	<0.01	0	0	10.32	5.05	4.39	34.76	19.75	17.38
	Humpback whale	5.32	1.99	1.54	0.05	<0.01	<0.01	10.71	5.40	4.57	10.78	5.38	4.55
	North Atlantic right whale [c]	4.22	1.62	1.30	0	0	0	10.23	5.18	4.32	10.30	5.13	4.31
	Sei whale [c]	4.13	1.31	1.30	0.04	0	0	10.92	5.34	4.64	35.10	20.69	18.48
MF	Atlantic white-sided dolphin	0	0	0	<0.01	0	0	10.19	4.98	4.30	4.50	2.08	1.74
	Atlantic spotted dolphin	0	0	0	0	0	0	10.59	4.84	4.47	4.66	2.18	1.84
	Short-beaked common dolphin	0	0	0	<0.01	0	0	10.40	5.10	4.36	4.67	2.07	1.73
	Bottlenose dolphin	0	0	0	0	0	0	9.36	4.65	4.04	4.21	1.82	1.51
	Risso's dolphin	0	0	0	<0.01	0	0	9.69	5.05	4.25	4.67	2.02	1.74
	Long-finned pilot whale	0	0	0	0	0	0	9.97	4.76	4.24	4.55	2.00	1.68
	Short-finned pilot whale	0	0	0	0	0	0	0	0	0	0	0	0
	Sperm whale [c]	0	0	0	0	0	0	10.49	5.27	4.54	4.72	2.24	1.86
HF	Harbor porpoise	0	0	0	0.55	0.23	<0.01	8.96	4.75	4.18	39.46	23.22	20.80
PPW	Gray seal	0.81	0	0	0	0	0	11.34	5.77	4.90	7.76	3.97	3.43
	Harbor seal	0.50	0	0	<0.01	0	0	9.37	4.56	3.97	6.48	3.31	2.84
	Harp seal	0.54	0	0	0.06	0	0	10.87	5.45	4.66	7.55	3.63	3.23

[a] NOAA (2005), [b] Wood et al. (2012), [c] Listed as Endangered under the ESA.

Table 22. 4 m pin pile, 3500 kJ hammer, four pin piles per day: Exposure ranges ($ER_{95\%}$) in km to marine mammal threshold criteria with sound attenuation.

Species		Injury						Behavior					
		L_E			L_{pk}			L_p [a]			L_p [b]		
		Attenuation (dB)						Attenuation (dB)					
		0	10	12	0	10	12	0	10	12	0	10	12
LF	Fin whale [c]	7.30	3.73	3.25	0.09	<0.01	<0.01	8.40	4.66	4.12	8.38	4.68	4.12
	Minke whale	4.34	1.76	1.46	0.01	<0.01	<0.01	7.91	4.24	3.63	23.65	14.41	13.10
	Humpback whale	6.52	2.94	2.49	0.04	<0.01	<0.01	8.23	4.65	4.10	8.24	4.66	4.10
	North Atlantic right whale [c]	5.20	2.35	1.89	0.09	0	0	7.91	4.54	3.80	7.95	4.55	3.81
	Sei whale [c]	4.75	2.10	1.54	0.07	<0.01	<0.01	8.06	4.52	4.06	24.68	14.78	13.21
MF	Atlantic white-sided dolphin	0	0	0	<0.01	0	0	7.91	4.40	3.79	4.59	2.28	1.92
	Atlantic spotted dolphin	0	0	0	0	0	0	7.89	4.47	4.05	4.86	2.37	1.86
	Short-beaked common dolphin	0	0	0	<0.01	0	0	7.80	4.48	3.84	4.71	2.30	1.96
	Bottlenose dolphin	0	0	0	0	0	0	7.24	4.02	3.46	4.22	1.98	1.63
	Risso's dolphin	0	0	0	0	0	0	7.78	4.31	3.75	4.55	2.24	1.89
	Long-finned pilot whale	0	0	0	0	0	0	7.61	4.11	3.60	4.50	2.17	1.89
	Short-finned pilot whale	0	0	0	0	0	0	0	0	0	0	0	0
	Sperm whale [c]	0	0	0	0	0	0	8.05	4.52	3.97	4.77	2.28	1.94
HF	Harbor porpoise	0.02	0	0	0.61	0.23	0.07	7.44	4.20	3.63	31.72	18.88	16.91
PPW	Gray seal	2.47	0.79	0.36	0.06	0	0	8.63	4.97	4.42	6.54	3.63	3.25
	Harbor seal	1.02	0.02	0	0.02	0	0	7.31	4.09	3.60	6.01	3.29	2.77
	Harp seal	1.15	0.11	0	0.09	<0.01	<0.01	8.32	4.65	4.10	6.29	3.49	3.07

[a] NOAA (2005), [b] Wood et al. (2012), [c] Listed as Endangered under the ESA.

3.2. Vibratory Pile Setting Followed by Impact Pile Driving – Exposure Ranges

Exposure ranges, or $ER_{95\%}$, are the horizontal distances that include 95% of the CPAs of animats exceeding a given impact threshold calculated for marine mammals. This section includes results for each of the modeled foundation types installed with vibratory setting of piles followed by impact pile driving, assuming 0-, 10-, and 12-dB broadband attenuation.

3.2.1. Injury

Table 23. Injury: Monopile foundation (12 m diameter, 5000 kJ hammer, one per day): Vibratory and impact exposure ranges ($ER_{95\%}$) in km to marine mammal threshold criteria with sound attenuation.

Species		Vibratory + Impact						Vibratory		
		L_E			L_{pk}			L_E		
		Attenuation (dB)								
		0	10	12	0	10	12	0	10	12
LF	Fin whale [a]	5.11	2.02	1.85	0.03	<0.01	<0.01	0.38	0.02	0
	Minke whale (migrating)	3.08	0.81	0.59	0	0	0	0	0	0
	Humpback whale	4.65	1.72	1.31	0	0	0	0.19	0	0
	North Atlantic right whale [a]	3.58	1.15	0.99	<0.01	0	0	0.02	0	0
	Sei whale [a] (migrating)	3.47	1.15	0.66	0	0	0	0	0	0
MF	Atlantic white-sided dolphin	0	0	0	<0.01	0	0	0	0	0
	Atlantic spotted dolphin	0	0	0	0	0	0	0	0	0
	Common dolphin	0	0	0	0	0	0	0	0	0
	Bottlenose dolphin, offshore	0	0	0	0	0	0	0	0	0
	Risso's dolphin	0	0	0	0	0	0	0	0	0
	Long-finned pilot whale	0	0	0	0	0	0	0	0	0
	Short-finned pilot whale	0	0	0	0	0	0	0	0	0
	Sperm whale [a]	0	0	0	0	0	0	0	0	0
HF	Harbor porpoise (sensitive)	0	0	0	0.47	0.09	<0.01	0	0	0
PW	Gray seal	0.62	0	0	0	0	0	0	0	0
	Harbor seal	0.26	0	0	0.02	0	0	0	0	0
	Harp seal	0.41	0	0	0.02	0	0	0	0	0

[a] Listed as Endangered under the ESA.

Table 24. Injury: Monopile foundation (12 m diameter, 5000 kJ hammer, two per day): Vibratory and impact exposure ranges ($ER_{95\%}$) in km to marine mammal threshold criteria with sound attenuation.

Species		Vibratory + Impact						Vibratory		
		L_E			L_{pk}			L_E		
		Attenuation (dB)								
		0	10	12	0	10	12	0	10	12
LF	Fin whale [a]	5.64	2.16	1.85	0.03	0	0	0.42	0	0
	Minke whale (migrating)	3.09	1.02	0.78	0	0	0	0.02	0	0
	Humpback whale	5.12	1.84	1.32	0.06	0	0	0.24	0	0
	North Atlantic right whale [a]	3.91	1.35	0.99	0.02	0	0	0.02	0	0
	Sei whale [a] (migrating)	3.49	1.29	0.73	0.02	0	0	0.02	0	0
MF	Atlantic white-sided dolphin	0	0	0	0	0	0	0	0	0
	Atlantic spotted dolphin	0	0	0	0	0	0	0	0	0
	Common dolphin	0	0	0	<0.01	0	0	0	0	0
	Bottlenose dolphin, offshore	0	0	0	0	0	0	0	0	0
	Risso's dolphin	0	0	0	<0.01	0	0	0	0	0
	Long-finned pilot whale	0	0	0	0	0	0	0	0	0
	Short-finned pilot whale	0	0	0	0	0	0	0	0	0
	Sperm whale [a]	0	0	0	0	0	0	0	0	0
HF	Harbor porpoise (sensitive)	0	0	0	0.47	<0.01	<0.01	0	0	0
PW	Gray seal	0.69	0	0	0	0	0	0	0	0
	Harbor seal	0.33	0	0	<0.01	0	0	0	0	0
	Harp seal	0.41	0	0	0.06	0	0	0	0	0

[a] Listed as Endangered under the ESA.

Table 25. Injury: Monopile foundation (12 m diameter, 6000 kJ hammer, one per day): Vibratory and impact exposure ranges ($ER_{95\%}$) in km to marine mammal threshold criteria with sound attenuation.

Species		Vibratory + Impact						Vibratory		
		L_E			L_{pk}			L_E		
		Attenuation (dB)								
		0	10	12	0	10	12	0	10	12
LF	Fin whale [a]	5.27	2.14	1.94	0.06	<0.01	<0.01	0.38	0.02	0
	Minke whale (migrating)	3.20	1.02	0.85	0	0	0	0	0	0
	Humpback whale	4.82	1.88	1.45	0.02	0	0	0.19	0	0
	North Atlantic right whale [a]	3.90	1.39	1.14	<0.01	<0.01	0	0.02	0	0
	Sei whale [a] (migrating)	3.74	1.64	0.81	0	0	0	0	0	0
MF	Atlantic white-sided dolphin	0	0	0	<0.01	0	0	0	0	0
	Atlantic spotted dolphin	0	0	0	<0.01	0	0	0	0	0
	Common dolphin	0	0	0	<0.01	0	0	0	0	0
	Bottlenose dolphin, offshore	0	0	0	0	0	0	0	0	0
	Risso's dolphin	0	0	0	0	0	0	0	0	0
	Long-finned pilot whale	0	0	0	0	0	0	0	0	0
	Short-finned pilot whale	0	0	0	0	0	0	0	0	0
	Sperm whale [a]	0	0	0	0	0	0	0	0	0
HF	Harbor porpoise (sensitive)	0	0	0	0.57	0.21	<0.01	0	0	0
PW	Gray seal	0.77	0	0	0	0	0	0	0	0
	Harbor seal	0.42	0	0	<0.01	0	0	0	0	0
	Harp seal	0.55	0	0	<0.01	0	0	0	0	0

[a] Listed as Endangered under the ESA.

Table 26. Injury: Monopile foundation (12 m diameter, 6000 kJ hammer, two per day): Vibratory and impact exposure ranges ($ER_{95\%}$) in km to marine mammal threshold criteria with sound attenuation.

Species		Vibratory + Impact						Vibratory		
		L_E			L_{pk}			L_E		
		Attenuation (dB)								
		0	10	12	0	10	12	0	10	12
LF	Fin whale [a]	5.71	2.24	1.95	0.04	0	0	0.42	0	0
	Minke whale (migrating)	3.42	1.21	0.76	<0.01	0	0	0.02	0	0
	Humpback whale	5.18	1.98	1.48	0.06	0	0	0.24	0	0
	North Atlantic right whale [a]	4.17	1.44	1.28	0.02	0	0	0.02	0	0
	Sei whale [a] (migrating)	3.84	1.26	0.94	0.06	0	0	0.02	0	0
MF	Atlantic white-sided dolphin	0	0	0	0	0	0	0	0	0
	Atlantic spotted dolphin	0	0	0	0	0	0	0	0	0
	Common dolphin	0	0	0	<0.01	0	0	0	0	0
	Bottlenose dolphin, offshore	0	0	0	0	0	0	0	0	0
	Risso's dolphin	0	0	0	<0.01	0	0	0	0	0
	Long-finned pilot whale	0	0	0	0	0	0	0	0	0
	Short-finned pilot whale	0	0	0	0	0	0	0	0	0
	Sperm whale [a]	0	0	0	0	0	0	0	0	0
HF	Harbor porpoise (sensitive)	0	0	0	0.51	0.14	<0.01	0	0	0
PW	Gray seal	0.69	0	0	0	0	0	0	0	0
	Harbor seal	0.37	0	0	<0.01	0	0	0	0	0
	Harp seal	0.51	0	0	0.04	0	0	0	0	0

[a] Listed as Endangered under the ESA.

Table 27. Injury: Monopile foundation (13 m diameter, 5000 kJ hammer, one per day): Vibratory and impact exposure ranges ($ER_{95\%}$) in km to marine mammal threshold criteria with sound attenuation.

Species		Vibratory + Impact						Vibratory		
		L_E			L_{pk}			L_E		
		Attenuation (dB)								
		0	10	12	0	10	12	0	10	12
LF	Fin whale [a]	5.68	2.10	1.85	0.02	0	0	0.04	0	0
	Minke whale (migrating)	3.60	0.95	0.84	0	0	0	0	0	0
	Humpback whale	5.02	1.90	1.44	0.05	0	0	0.07	0	0
	North Atlantic right whale [a]	4.11	1.29	1.17	0.01	0	0	0.02	0	0
	Sei whale [a] (migrating)	3.76	1.23	0.93	0	0	0	0	0	0
MF	Atlantic white-sided dolphin	0	0	0	0	0	0	0	0	0
	Atlantic spotted dolphin	0	0	0	0	0	0	0	0	0
	Common dolphin	0	0	0	<0.01	0	0	0	0	0
	Bottlenose dolphin, offshore	0	0	0	0	0	0	0	0	0
	Risso's dolphin	0	0	0	0	0	0	0	0	0
	Long-finned pilot whale	0	0	0	0	0	0	0	0	0
	Short-finned pilot whale	0	0	0	0	0	0	0	0	0
	Sperm whale [a]	0	0	0	0	0	0	0	0	0
HF	Harbor porpoise (sensitive)	0	0	0	0.54	0.21	0	0	0	0
PW	Gray seal	0.72	0	0	0	0	0	0	0	0
	Harbor seal	0.33	0	0	0.03	0	0	0	0	0
	Harp seal	0.38	0	0	0.06	0	0	0	0	0

[a] Listed as Endangered under the ESA.

Table 28. Injury: Monopile foundation (13 m diameter, 5000 kJ hammer, two per day): Vibratory and impact exposure ranges ($ER_{95\%}$) in km to marine mammal threshold criteria with sound attenuation.

Species		Vibratory + Impact						Vibratory		
		L_E			L_{pk}			L_E		
		Attenuation (dB)								
		0	10	12	0	10	12	0	10	12
LF	Fin whale [a]	6.01	2.61	1.97	<0.01	0	0	0.32	0	0
	Minke whale (migrating)	3.47	0.99	0.67	0.02	0	0	0	0	0
	Humpback whale	5.29	2.05	1.49	0.04	<0.01	<0.01	0.15	0	0
	North Atlantic right whale [a]	4.04	1.40	1.11	0	0	0	0	0	0
	Sei whale [a] (migrating)	3.89	1.30	1.15	0	0	0	0	0	0
MF	Atlantic white-sided dolphin	0	0	0	0	0	0	0	0	0
	Atlantic spotted dolphin	0	0	0	0	0	0	0	0	0
	Common dolphin	0	0	0	<0.01	0	0	0	0	0
	Bottlenose dolphin, offshore	0	0	0	0	0	0	0	0	0
	Risso's dolphin	0	0	0	<0.01	0	0	0	0	0
	Long-finned pilot whale	0	0	0	<0.01	0	0	0	0	0
	Short-finned pilot whale	0	0	0	0	0	0	0	0	0
	Sperm whale [a]	0	0	0	0	0	0	0	0	0
HF	Harbor porpoise (sensitive)	0.03	0	0	0.55	0.13	0.03	0	0	0
PW	Gray seal	0.72	0	0	0	0	0	0	0	0
	Harbor seal	0.50	0	0	<0.01	<0.01	0	0	0	0
	Harp seal	0.54	0	0	0.05	0	0	0	0	0

[a] Listed as Endangered under the ESA.

Table 29. Injury: Monopile foundation (13 m diameter, 6000 kJ hammer, one per day): Vibratory and impact exposure ranges ($ER_{95\%}$) in km to marine mammal threshold criteria with sound attenuation.

Species		Vibratory + Impact						Vibratory		
		L_E			L_{pk}			L_E		
		Attenuation (dB)								
		0	10	12	0	10	12	0	10	12
LF	Fin whale [a]	5.81	2.16	1.97	0.03	0	0	0.04	0	0
	Minke whale (migrating)	3.76	1.20	0.88	0	0	0	0	0	0
	Humpback whale	5.17	1.94	1.55	0.06	0	0	0.07	0	0
	North Atlantic right whale [a]	4.43	1.54	1.22	0.02	0	0	0.02	0	0
	Sei whale [a] (migrating)	4.17	1.27	1.00	0.06	0	0	0	0	0
MF	Atlantic white-sided dolphin	0	0	0	0	0	0	0	0	0
	Atlantic spotted dolphin	0	0	0	0	0	0	0	0	0
	Common dolphin	0	0	0	0	0	0	0	0	0
	Bottlenose dolphin, offshore	0	0	0	0	0	0	0	0	0
	Risso's dolphin	0	0	0	<0.01	0	0	0	0	0
	Long-finned pilot whale	0	0	0	0	0	0	0	0	0
	Short-finned pilot whale	0	0	0	0	0	0	0	0	0
	Sperm whale [a]	0	0	0	0	0	0	0	0	0
HF	Harbor porpoise (sensitive)	0	0	0	0.60	0.24	<0.01	0	0	0
PW	Gray seal	0.72	0	0	0	0	0	0	0	0
	Harbor seal	0.51	0	0	0	0	0	0	0	0
	Harp seal	0.57	0	0	0.04	0	0	0	0	0

[a] Listed as Endangered under the ESA.

Table 30. Injury: Monopile foundation (13 m diameter, 6000 kJ hammer, two per day): Vibratory and impact exposure ranges ($ER_{95\%}$) in km to marine mammal threshold criteria with sound attenuation.

Species		Vibratory + Impact						Vibratory		
		L_E			L_{pk}			L_E		
		Attenuation (dB)								
		0	10	12	0	10	12	0	10	12
LF	Fin whale [a]	6.29	2.69	2.08	0.06	0	0	0.32	0	0
	Minke whale (migrating)	3.76	1.18	0.95	<0.01	0	0	0	0	0
	Humpback whale	5.52	2.07	1.75	0.05	<0.01	<0.01	0.15	0	0
	North Atlantic right whale [a]	4.32	1.59	1.30	0	0	0	0	0	0
	Sei whale [a] (migrating)	4.28	1.33	1.30	0.04	0	0	0	0	0
MF	Atlantic white-sided dolphin	0	0	0	<0.01	0	0	0	0	0
	Atlantic spotted dolphin	0	0	0	0	0	0	0	0	0
	Common dolphin	0	0	0	<0.01	0	0	0	0	0
	Bottlenose dolphin, offshore	0	0	0	0	0	0	0	0	0
	Risso's dolphin	0	0	0	<0.01	0	0	0	0	0
	Long-finned pilot whale	0	0	0	0	0	0	0	0	0
	Short-finned pilot whale	0	0	0	0	0	0	0	0	0
	Sperm whale [a]	0	0	0	0	0	0	0	0	0
HF	Harbor porpoise (sensitive)	0.06	0	0	0.58	0.06	<0.01	0	0	0
PW	Gray seal	0.81	0	0	0	0	0	0	0	0
	Harbor seal	0.33	0	0	<0.01	0	0	0	0	0
	Harp seal	0.53	0	0	0.07	0	0	0	0	0

[a] Listed as Endangered under the ESA.

Table 31. Injury: Post-piled jacket foundation (4 m diameter, 3500 kJ hammer, four piles per day): Vibratory and impact exposure ranges ($ER_{95\%}$) in km to marine mammal threshold criteria with sound attenuation.

Species		Vibratory + Impact						Vibratory		
		L_E			L_{pk}			L_E		
		Attenuation (dB)								
		0	10	12	0	10	12	0	10	12
LF	Fin whale [a]	7.99	4.02	3.58	0.07	<0.01	<0.01	1.10	0.04	0.04
	Minke whale (migrating)	4.61	1.94	1.50	0.01	<0.01	<0.01	0.33	0	0
	Humpback whale	7.03	3.32	2.79	0.04	<0.01	<0.01	1.05	0	0
	North Atlantic right whale [a]	5.61	2.44	2.15	0.09	0	0	0.58	0	0
	Sei whale [a] (migrating)	4.99	2.16	1.68	0.08	<0.01	<0.01	0.39	0	0
MF	Atlantic white-sided dolphin	0	0	0	<0.01	0	0	0	0	0
	Atlantic spotted dolphin	0	0	0	<0.01	0	0	0	0	0
	Common dolphin	0	0	0	<0.01	0	0	0	0	0
	Bottlenose dolphin, offshore	0	0	0	0	0	0	0	0	0
	Risso's dolphin	0	0	0	0	0	0	0	0	0
	Long-finned pilot whale	0	0	0	0	0	0	0	0	0
	Short-finned pilot whale	0	0	0	0	0	0	0	0	0
	Sperm whale [a]	0	0	0	0	0	0	0	0	0
HF	Harbor porpoise (sensitive)	0.23	0	0	0.62	0.23	0.07	0	0	0
PW	Gray seal	2.71	0.79	0.36	0.07	0	0	0	0	0
	Harbor seal	1.02	0.07	0	0.02	0	0	0	0	0
	Harp seal	1.35	0.12	0.13	0.09	0	0	0	0	0

[a] Listed as Endangered under the ESA.

3.2.2. Behavior

Table 32. Behavior: Monopile foundation (12 m diameter, 5000 kJ hammer, one per day): Vibratory and impact exposure ranges ($ER_{95\%}$) in km to marine mammal threshold criteria with sound attenuation.

Species		Impact						Vibratory		
		L_p [a]			L_p [b]			L_p [a]		
		Attenuation (dB)						Attenuation (dB)		
		0	10	12	0	10	12	0	10	12
LF	Fin whale [c]	10.03	4.97	4.25	10.02	4.83	4.24	32.93	22.22	20.52
	Minke whale (migrating)	9.41	4.49	3.83	26.37	16.41	14.62	32.51	22.06	20.29
	Humpback whale	9.85	4.83	4.13	9.81	4.73	4.13	32.93	22.26	20.67
	North Atlantic right whale [c]	9.13	4.49	3.63	9.19	4.35	3.65	31.22	20.96	19.62
	Sei whale [c] (migrating)	9.89	4.60	3.82	27.89	17.21	15.54	32.94	22.30	20.62
MF	Atlantic white-sided dolphin	8.99	4.32	3.70	4.06	1.67	1.38	32.57	22.07	20.11
	Atlantic spotted dolphin	9.30	4.80	3.70	4.34	1.62	1.42	34.53	23.35	21.03
	Common dolphin	9.32	4.44	3.90	4.14	1.89	1.49	32.83	21.97	20.43
	Bottlenose dolphin, offshore	8.38	4.03	3.42	3.63	1.46	1.16	31.32	21.21	19.41
	Risso's dolphin	8.67	4.42	3.60	3.95	1.69	1.24	31.01	21.05	19.72
	Long-finned pilot whale	8.99	4.21	3.56	4.12	1.62	1.37	32.21	21.72	20.11
	Short-finned pilot whale	0	0	0	0	0	0	0	0	0
	Sperm whale [c]	9.39	4.68	4.06	4.39	1.76	1.51	32.65	21.97	20.32
HF	Harbor porpoise (sensitive)	8.13	4.29	3.44	32.93	20.75	18.98	27.57	19.32	17.49
PW	Gray seal	10.39	5.16	4.51	7.25	3.45	2.95	33.13	22.32	20.66
	Harbor seal	8.81	3.81	3.33	5.90	2.80	2.36	28.12	19.80	18.29
	Harp seal	9.74	5.03	4.24	6.88	3.20	2.74	33.03	22.45	20.60

[a] NOAA (2005), [b] Wood et al. (2012), [c] Listed as Endangered under the ESA

Table 33. Behavior: Monopile foundation (12 m diameter, 5000 kJ hammer, two per day): Vibratory and impact exposure ranges ($ER_{95\%}$) in km to marine mammal threshold criteria with sound attenuation.

Species		Impact						Vibratory		
		L_p [a]			L_p [b]			L_p [a]		
		Attenuation (dB)						Attenuation (dB)		
		0	10	12	0	10	12	0	10	12
LF	Fin whale [c]	9.95	4.89	4.17	9.95	4.76	4.18	32.98	22.14	20.54
	Minke whale (migrating)	9.28	4.43	3.85	26.31	16.29	14.58	32.45	21.93	20.14
	Humpback whale	9.62	4.73	4.04	9.69	4.67	4.02	32.95	22.28	20.59
	North Atlantic right whale [c]	9.17	4.38	3.95	9.29	4.34	3.95	31.33	21.10	19.53
	Sei whale [c] (migrating)	9.42	4.63	3.92	27.95	16.85	15.31	32.92	22.08	20.37
MF	Atlantic white-sided dolphin	9.01	4.40	3.60	4.00	1.76	1.33	32.16	21.72	20.14
	Atlantic spotted dolphin	9.24	4.22	3.51	3.87	1.82	1.38	34.05	23.10	21.20
	Common dolphin	9.04	4.34	3.83	4.12	1.69	1.47	32.30	21.89	20.08
	Bottlenose dolphin, offshore	8.01	3.71	3.21	3.41	1.42	1.21	31.17	20.81	19.34
	Risso's dolphin	8.64	4.27	3.64	4.09	1.76	1.53	30.73	20.79	19.44
	Long-finned pilot whale	8.85	4.20	3.43	3.97	1.62	1.35	32.23	21.59	19.79
	Short-finned pilot whale	0	0	0	0	0	0	0	0	0
	Sperm whale [c]	9.37	4.59	3.94	4.34	1.96	1.51	32.66	21.95	20.28
HF	Harbor porpoise (sensitive)	8.03	3.99	3.41	32.57	20.68	18.96	26.96	19.03	17.27
PW	Gray seal	10.25	5.13	4.42	7.28	3.40	2.98	33.25	22.29	20.55
	Harbor seal	8.69	4.03	3.51	5.79	2.69	2.25	27.73	19.89	18.12
	Harp seal	9.72	4.90	4.13	6.72	3.16	2.65	33.24	22.43	20.56

[a] NOAA (2005), [b] Wood et al. (2012), [c] Listed as Endangered under the ESA

Table 34. Behavior: Monopile foundation (12 m diameter, 6000 kJ hammer, one per day): Vibratory and impact exposure ranges ($ER_{95\%}$) in km to marine mammal threshold criteria with sound attenuation

Species		Impact						Vibratory		
		L_p [a]			L_p [b]			L_p [a]		
		Attenuation (dB)						Attenuation (dB)		
		0	10	12	0	10	12	0	10	12
LF	Fin whale [c]	10.52	5.30	4.59	10.59	5.29	4.56	32.93	22.22	20.52
	Minke whale (migrating)	9.94	5.01	4.32	27.95	17.40	15.74	32.51	22.06	20.29
	Humpback whale	10.39	5.35	4.62	10.41	5.25	4.58	32.93	22.26	20.67
	North Atlantic right whale [c]	9.79	4.91	4.22	9.84	4.95	4.20	31.22	20.96	19.62
	Sei whale [c] (migrating)	10.49	5.21	4.26	29.19	18.69	16.40	32.94	22.30	20.62
MF	Atlantic white-sided dolphin	9.81	5.08	4.16	4.61	1.97	1.68	32.57	22.07	20.11
	Atlantic spotted dolphin	10.20	5.17	4.13	4.90	1.98	1.94	34.53	23.35	21.03
	Common dolphin	10.00	5.02	4.21	4.56	2.05	1.80	32.83	21.97	20.43
	Bottlenose dolphin, offshore	9.27	4.29	3.59	4.01	1.94	1.72	31.32	21.21	19.41
	Risso's dolphin	9.43	4.78	4.02	4.50	2.04	1.60	31.01	21.05	19.72
	Long-finned pilot whale	9.66	4.86	4.03	4.55	1.90	1.64	32.21	21.72	20.11
	Short-finned pilot whale	0	0	0	0	0	0	0	0	0
	Sperm whale [c]	10.19	5.17	4.41	4.70	2.05	1.81	32.65	21.97	20.32
HF	Harbor porpoise (sensitive)	8.79	4.56	3.89	34.81	21.94	19.88	27.57	19.32	17.49
PW	Gray seal	10.86	5.67	4.74	7.61	3.73	3.10	33.13	22.32	20.66
	Harbor seal	9.48	4.35	3.73	6.67	3.27	2.58	28.12	19.80	18.29
	Harp seal	10.41	5.25	4.42	7.43	3.44	2.96	33.03	22.45	20.60

[a] NOAA (2005), [b] Wood et al. (2012), [c] Listed as Endangered under the ESA

Table 35. Behavior: Monopile foundation (12 m diameter, 6000 kJ hammer, two per day): Vibratory and impact exposure ranges ($ER_{95\%}$) in km to marine mammal threshold criteria with sound attenuation.

Species		Impact						Vibratory		
		L_p [a]			L_p [b]			L_p [a]		
		Attenuation (dB)						Attenuation (dB)		
		0	10	12	0	10	12	0	10	12
LF	Fin whale [c]	10.43	5.31	4.47	10.48	5.31	4.42	32.98	22.14	20.54
	Minke whale (migrating)	9.94	4.92	4.15	27.97	17.50	15.71	32.45	21.93	20.14
	Humpback whale	10.35	5.18	4.34	10.48	5.19	4.30	32.95	22.28	20.59
	North Atlantic right whale [c]	9.77	4.83	4.18	9.83	4.84	4.17	31.33	21.10	19.53
	Sei whale [c] (migrating)	10.28	5.24	4.30	29.48	18.14	16.30	32.92	22.08	20.37
MF	Atlantic white-sided dolphin	9.77	4.97	4.09	4.49	2.00	1.69	32.16	21.72	20.14
	Atlantic spotted dolphin	10.06	4.71	3.99	4.38	2.05	1.75	34.05	23.10	21.20
	Common dolphin	9.80	4.90	4.15	4.51	2.08	1.70	32.30	21.89	20.08
	Bottlenose dolphin, offshore	8.82	4.41	3.66	4.05	1.84	1.53	31.17	20.81	19.34
	Risso's dolphin	9.34	4.71	4.10	4.45	2.04	1.68	30.73	20.79	19.44
	Long-finned pilot whale	9.70	4.76	4.05	4.43	1.87	1.58	32.23	21.59	19.79
	Short-finned pilot whale	0	0	0	0	0	0	0	0	0
	Sperm whale [c]	10.02	5.11	4.31	4.70	2.13	1.79	32.66	21.95	20.28
HF	Harbor porpoise (sensitive)	8.67	4.38	3.73	34.40	22.08	20.19	26.96	19.03	17.27
PW	Gray seal	10.67	5.53	4.70	7.82	3.72	3.16	33.25	22.29	20.55
	Harbor seal	9.33	4.42	3.82	6.33	3.03	2.57	27.73	19.89	18.12
	Harp seal	10.36	5.24	4.46	7.29	3.40	2.96	33.24	22.43	20.56

[a] NOAA (2005), [b] Wood et al. (2012), [c] Listed as Endangered under the ESA

Table 36. Behavior: Monopile foundation (13 m diameter, 5000 kJ hammer, one per day): Vibratory and impact exposure ranges ($ER_{95\%}$) in km to marine mammal threshold criteria with sound attenuation.

Species		Impact						Vibratory		
		L_p [a]			L_p [b]			L_p [a]		
		Attenuation (dB)						Attenuation (dB)		
		0	10	12	0	10	12	0	10	12
LF	Fin whale [c]	10.70	5.12	4.30	10.62	5.12	4.29	45.57	29.40	26.55
	Minke whale (migrating)	9.80	4.62	4.12	32.60	18.55	16.48	44.13	28.66	25.87
	Humpback whale	10.42	5.09	4.35	10.44	5.10	4.20	45.51	29.27	26.65
	North Atlantic right whale [c]	9.81	4.58	4.06	9.85	4.75	4.02	42.10	28.07	25.50
	Sei whale [c] (migrating)	10.47	4.85	4.23	34.98	20.03	17.69	45.60	29.29	26.38
MF	Atlantic white-sided dolphin	9.66	4.50	4.06	4.30	1.76	1.42	43.60	28.30	25.61
	Atlantic spotted dolphin	9.96	4.66	4.12	4.35	2.12	1.42	45.98	29.75	27.04
	Common dolphin	9.64	4.61	3.94	4.23	1.92	1.54	45.27	29.10	26.30
	Bottlenose dolphin, offshore	8.90	4.15	3.46	3.64	1.50	1.31	43.94	27.88	25.22
	Risso's dolphin	9.16	4.60	3.97	4.34	1.86	1.54	41.67	27.16	24.56
	Long-finned pilot whale	9.29	4.50	3.89	4.20	1.95	1.45	42.25	27.77	25.17
	Short-finned pilot whale	0	0	0	0	0	0	0	0	0
	Sperm whale [c]	10.14	4.87	4.26	4.54	2.03	1.66	45.24	29.15	26.15
HF	Harbor porpoise (sensitive)	8.73	4.41	3.79	37.09	21.67	19.51	34.64	23.33	21.42
PW	Gray seal	10.73	5.42	4.74	7.30	3.70	3.13	45.74	29.51	26.60
	Harbor seal	8.95	4.33	3.68	5.96	3.08	2.40	36.75	24.96	22.88
	Harp seal	10.35	5.11	4.36	6.89	3.32	2.84	45.58	29.45	26.46

[a] NOAA (2005), [b] Wood et al. (2012), [c] Listed as Endangered under the ESA

Table 37. Behavior: Monopile foundation (13 m diameter, 5000 kJ hammer, two per day): Vibratory and impact exposure ranges ($ER_{95\%}$) in km to marine mammal threshold criteria with sound attenuation.

Species		Impact						Vibratory		
		L_p [a]			L_p [b]			L_p [a]		
		Attenuation (dB)						Attenuation (dB)		
		0	10	12	0	10	12	0	10	12
LF	Fin whale [c]	10.43	4.97	4.41	10.44	4.98	4.34	45.76	29.41	26.49
	Minke whale (migrating)	9.70	4.75	4.07	32.57	18.57	16.22	43.53	28.38	25.59
	Humpback whale	10.22	4.95	4.34	10.26	4.98	4.30	45.27	29.03	26.39
	North Atlantic right whale [c]	9.67	4.52	3.86	9.76	4.51	3.86	42.40	27.45	25.01
	Sei whale [c] (migrating)	10.34	5.02	4.24	33.44	19.89	17.33	45.13	29.02	25.99
MF	Atlantic white-sided dolphin	9.36	4.57	3.89	4.28	1.80	1.49	44.12	28.64	25.76
	Atlantic spotted dolphin	9.85	4.68	3.88	4.29	1.99	1.47	46.54	30.12	27.22
	Common dolphin	9.60	4.64	4.04	4.33	1.94	1.59	44.42	28.53	25.76
	Bottlenose dolphin, offshore	8.69	4.12	3.43	3.66	1.57	1.25	43.34	27.42	24.63
	Risso's dolphin	9.17	4.59	3.96	4.26	1.84	1.53	42.88	27.41	24.79
	Long-finned pilot whale	9.17	4.48	3.81	4.21	1.80	1.54	42.16	27.45	24.96
	Short-finned pilot whale	0	0	0	0	0	0	0	0	0
	Sperm whale [c]	9.92	4.86	4.16	4.31	2.05	1.61	45.17	28.87	26.02
HF	Harbor porpoise (sensitive)	8.32	4.37	3.76	37.44	21.85	19.53	34.17	23.20	21.20
PW	Gray seal	10.67	5.34	4.65	7.25	3.72	3.08	45.85	29.53	26.63
	Harbor seal	8.72	4.15	3.69	5.83	3.04	2.65	36.64	24.58	22.59
	Harp seal	10.28	4.98	4.38	6.88	3.38	2.88	45.51	29.44	26.28

[a] NOAA (2005), [b] Wood et al. (2012), [c] Listed as Endangered under the ESA

Table 38. Behavior: Monopile foundation (13 m diameter, 6000 kJ hammer, one per day): Vibratory and impact exposure ranges ($ER_{95\%}$) in km to marine mammal threshold criteria with sound attenuation.

Species		Impact						Vibratory		
		L_p [a]			L_p [b]			L_p [a]		
		Attenuation (dB)						Attenuation (dB)		
		0	10	12	0	10	12	0	10	12
LF	Fin whale [c]	11.18	5.59	4.77	11.27	5.59	4.76	45.57	29.40	26.55
	Minke whale (migrating)	10.56	5.19	4.53	34.63	19.97	17.67	44.13	28.66	25.87
	Humpback whale	10.97	5.42	4.70	11.01	5.39	4.69	45.51	29.27	26.65
	North Atlantic right whale [c]	10.54	5.08	4.40	10.58	5.07	4.40	42.10	28.07	25.50
	Sei whale [c] (migrating)	11.10	5.38	4.50	36.77	21.28	19.02	45.60	29.29	26.38
MF	Atlantic white-sided dolphin	10.35	5.04	4.27	4.53	2.09	1.72	43.60	28.30	25.61
	Atlantic spotted dolphin	10.72	5.05	4.39	4.73	2.38	2.05	45.98	29.75	27.04
	Common dolphin	10.46	5.28	4.34	4.65	2.16	1.63	45.27	29.10	26.30
	Bottlenose dolphin, offshore	9.74	4.61	4.00	4.33	1.73	1.39	43.94	27.88	25.22
	Risso's dolphin	9.87	4.99	4.26	4.68	2.11	1.80	41.67	27.16	24.56
	Long-finned pilot whale	10.12	4.84	4.19	4.58	1.94	1.60	42.25	27.77	25.17
	Short-finned pilot whale	0	0	0	0	0	0	0	0	0
	Sperm whale [c]	10.80	5.40	4.71	4.87	2.17	1.81	45.24	29.15	26.15
HF	Harbor porpoise (sensitive)	9.09	4.82	4.03	39.00	22.86	20.79	34.64	23.33	21.42
PW	Gray seal	11.34	5.83	4.90	7.75	3.84	3.43	45.74	29.51	26.60
	Harbor seal	9.55	4.56	3.97	6.39	3.40	2.88	36.75	24.96	22.88
	Harp seal	10.97	5.49	4.72	7.48	3.61	3.13	45.58	29.45	26.46

[a] NOAA (2005), [b] Wood et al. (2012), [c] Listed as Endangered under the ESA

Table 39. Behavior: Monopile foundation (13 m diameter, 6000 kJ hammer, two per day): Vibratory and impact exposure ranges ($ER_{95\%}$) in km to marine mammal threshold criteria with sound attenuation.

Species		Impact						Vibratory		
		L_p [a]			L_p [b]			L_p [a]		
		Attenuation (dB)						Attenuation (dB)		
		0	10	12	0	10	12	0	10	12
LF	Fin whale [c]	11.07	5.49	4.62	11.10	5.48	4.63	45.76	29.41	26.49
	Minke whale (migrating)	10.50	5.21	4.43	34.79	19.83	17.50	43.53	28.38	25.59
	Humpback whale	10.78	5.43	4.66	10.86	5.43	4.66	45.27	29.03	26.39
	North Atlantic right whale [c]	10.36	5.11	4.39	10.41	5.09	4.40	42.40	27.45	25.01
	Sei whale [c] (migrating)	11.10	5.43	4.61	35.23	20.78	18.60	45.13	29.02	25.99
MF	Atlantic white-sided dolphin	10.41	5.03	4.36	4.66	2.11	1.81	44.12	28.64	25.76
	Atlantic spotted dolphin	10.68	4.90	4.45	4.66	2.22	1.85	46.54	30.12	27.22
	Common dolphin	10.40	5.19	4.48	4.75	2.09	1.70	44.42	28.53	25.76
	Bottlenose dolphin, offshore	9.51	4.76	3.95	4.13	1.85	1.48	43.34	27.42	24.63
	Risso's dolphin	9.79	5.08	4.26	4.67	2.08	1.80	42.88	27.41	24.79
	Long-finned pilot whale	9.96	4.83	4.25	4.57	2.03	1.66	42.16	27.45	24.96
	Short-finned pilot whale	0	0	0	0	0	0	0	0	0
	Sperm whale [c]	10.57	5.28	4.54	4.71	2.25	1.78	45.17	28.87	26.02
HF	Harbor porpoise (sensitive)	8.92	4.84	4.17	39.40	23.24	20.91	34.17	23.20	21.20
PW	Gray seal	11.36	5.78	4.88	7.81	3.97	3.44	45.85	29.53	26.63
	Harbor seal	9.41	4.69	4.05	6.52	3.33	2.82	36.64	24.58	22.59
	Harp seal	10.91	5.48	4.78	7.53	3.61	3.21	45.51	29.44	26.28

[a] NOAA (2005), [b] Wood et al. (2012), [c] Listed as Endangered under the ESA

Table 40. Behavior: Post-piled jacket foundation (4 m diameter, 3500 kJ hammer, four piles per day): Vibratory and impact exposure ranges ($ER_{95\%}$) in km to marine mammal threshold criteria with sound attenuation.

Species		Impact						Vibratory		
		L_p [a]			L_p [b]			L_p [a]		
		Attenuation (dB)						Attenuation (dB)		
		0	10	12	0	10	12	0	10	12
LF	Fin whale [c]	8.43	4.63	4.15	8.41	4.65	4.16	39.43	27.74	25.83
	Minke whale (migrating)	7.93	4.22	3.67	23.72	14.48	13.16	38.54	26.94	24.85
	Humpback whale	8.28	4.70	4.10	8.27	4.74	4.11	39.09	27.43	25.57
	North Atlantic right whale [c]	7.94	4.47	3.84	7.96	4.48	3.85	36.15	25.66	23.87
	Sei whale [c] (migrating)	8.09	4.56	4.04	24.83	14.68	13.23	40.51	28.05	26.16
MF	Atlantic white-sided dolphin	8.07	4.41	3.84	4.62	2.29	1.94	38.97	27.16	25.04
	Atlantic spotted dolphin	7.82	4.50	4.00	4.87	2.37	1.85	41.77	29.06	27.08
	Common dolphin	7.87	4.46	3.87	4.73	2.28	1.97	38.91	27.04	25.13
	Bottlenose dolphin, offshore	7.29	4.09	3.52	4.24	1.97	1.68	37.25	25.85	23.94
	Risso's dolphin	7.84	4.30	3.73	4.56	2.27	1.90	38.05	26.51	24.53
	Long-finned pilot whale	7.67	4.18	3.61	4.56	2.22	1.90	38.51	26.89	24.79
	Short-finned pilot whale	0	0	0	0	0	0	0	0	0
	Sperm whale [c]	8.10	4.54	3.99	4.79	2.27	1.94	39.03	27.11	25.36
HF	Harbor porpoise (sensitive)	7.40	4.21	3.68	31.92	18.94	17.01	32.16	23.26	21.72
PW	Gray seal	8.63	4.98	4.42	6.55	3.63	3.25	38.69	27.41	25.51
	Harbor seal	7.31	4.11	3.60	6.00	3.31	2.78	32.47	23.55	22.23
	Harp seal	8.32	4.64	4.14	6.34	3.57	3.06	39.24	27.65	25.76

[a] NOAA (2005), [b] Wood et al. (2012), [c] Listed as Endangered under the ESA

3.3. Drilling – Acoustic Ranges

The acoustic ranges to injury thresholds for marine mammal hearing groups are shown in Tables 41–49 for the different modeling locations (J1, M1, and M2) and attenuations (0, 10, and 12 dB). Similarly, acoustic ranges to behavioral threshold (SPL 120 dB re 1 µPa), without frequency weighting, are shown in Tables 61–63 for the modeling locations (J1, M1, and M2) and attenuations (0, 10, and 12 dB) during the summer. Modeling locations are shown in Figure 7.

Table 41. Site J1 (Summer): Distances to PTS onset for marine mammal hearing groups (NMFS 2018) thresholds for continuous sounds generated by relief drilling during piling for attenuation 0 dB.

Hearing group	Frequency- weighted $L_{E,24hr}$ (dB re 1 µPa²·s)	Drilling		
		24 hr		
		R_{max} (km)	$R_{95\%}$ (km)	Area (km²)
Low-frequency (LF) cetaceans	199	0.315	0.309	0.320
Mid-frequency (MF) cetaceans	198	-	-	-
High-frequency (HF) cetaceans	173	0.261	0.251	0.207
Phocid pinnipeds in water (PPW)	201	0.057	0.057	0.015

Table 42. Site M1 (Summer): Distances to PTS onset for marine mammal hearing groups (NMFS 2018) thresholds for continuous sounds generated by relief drilling during piling for attenuation 0 dB.

Hearing group	Frequency-weighted $L_{E,24hr}$ (dB re 1 µPa²·s)	Drilling		
		24 hr		
		R_{max} (km)	$R_{95\%}$ (km)	Area (km²)
Low-frequency (LF) cetaceans	199	0.317	0.312	0.318
Mid-frequency (MF) cetaceans	198	-	-	-
High-frequency (HF) cetaceans	173	0.276	0.273	0.243
Phocid pinnipeds in water (PPW)	201	0.067	0.067	0.015

Table 43. Site M2 (Summer): Distances to PTS onset for marine mammal hearing groups (NMFS 2018) thresholds for continuous sounds generated by relief drilling during piling for attenuation 0 dB.

Hearing group	Frequency-weighted $L_{E,24hr}$ (dB re 1 µPa²·s)	Drilling		
		24 hr		
		R_{max} (km)	$R_{95\%}$ (km)	Area (km²)
Low-frequency (LF) cetaceans	199	0.323	0.296	0.285
Mid-frequency (MF) cetaceans	198	-	-	-
High-frequency (HF) cetaceans	173	0.255	0.248	0.207
Phocid pinnipeds in water (PPW)	201	0.065	0.065	0.012

Table 44. Site J1 (Summer): Distances to PTS onset for marine mammal hearing groups (NMFS 2018) thresholds for continuous sounds generated by relief drilling during piling for attenuation 10 dB.

Hearing group	Frequency-weighted $L_{E,24hr}$ (dB re 1 µPa²·s)	Drilling		
		24 hr		
		R_{max} (km)	$R_{95\%}$ (km)	Area (km²)
Low-frequency (LF) cetaceans	199	0.057	0.057	0.015
Mid-frequency (MF) cetaceans	198	-	-	-
High-frequency (HF) cetaceans	173	0.057	0.057	0.015
Phocid pinnipeds in water (PPW)	201	-	-	-

Table 45. Site M1 (Summer): Distances to PTS onset for marine mammal hearing groups (NMFS 2018) thresholds for continuous sounds generated by relief drilling during piling for attenuation 10 dB.

Hearing group	Frequency-weighted $L_{E,24hr}$ (dB re 1 µPa²·s)	Drilling		
		24 hr		
		R_{max} (km)	$R_{95\%}$ (km)	Area (km²)
Low-frequency (LF) cetaceans	199	0.065	0.065	0.012
Mid-frequency (MF) cetaceans	198	-	-	-
High-frequency (HF) cetaceans	173	<0.05	<0.05	0.010
Phocid pinnipeds in water (PPW)	201	-	-	-

Table 46. Site M2 (Summer): Distances to PTS onset for marine mammal hearing groups (NMFS 2018) thresholds for continuous sounds generated by relief drilling during piling for attenuation 10 dB.

Hearing group	Frequency-weighted $L_{E,24hr}$ (dB re 1 µPa²·s)	Drilling		
		24 hr		
		R_{max} (km)	$R_{95\%}$ (km)	Area (km²)
Low-frequency (LF) cetaceans	199	<0.05	<0.05	0.010
Mid-frequency (MF) cetaceans	198	-	-	-
High-frequency (HF) cetaceans	173	<0.05	<0.05	0.010
Phocid pinnipeds in water (PPW)	201	-	-	-

Table 47. Site J1 (Summer): Distances to PTS onset for marine mammal hearing groups (NMFS 2018) thresholds for continuous sounds generated by relief drilling during piling for attenuation 12 dB.

Hearing group	Frequency-weighted $L_{E,24hr}$ (dB re 1 µPa²·s)	Drilling		
		24 hr		
		R_{max} (km)	$R_{95\%}$ (km)	Area (km²)
Low-frequency (LF) cetaceans	199	<0.05	<0.05	<0.05
Mid-frequency (MF) cetaceans	198	-	-	-
High-frequency (HF) cetaceans	173	<0.05	<0.05	<0.05
Phocid pinnipeds in water (PPW)	201	-	-	-

Table 48. Site M1 (Summer): Distances to PTS onset for marine mammal hearing groups (NMFS 2018) thresholds for continuous sounds generated by relief drilling during piling for attenuation 12 dB

Hearing group	Frequency- weighted $L_{E,24hr}$ (dB re 1 µPa²·s)	Drilling		
		24 hr		
		R_{max} (km)	$R_{95\%}$ (km)	Area (km²)
Low-frequency (LF) cetaceans	199	<0.05	<0.05	0.005
Mid-frequency (MF) cetaceans	198	-	-	-
High-frequency (HF) cetaceans	173	<0.05	<0.05	0.005
Phocid pinnipeds in water (PPW)	201	-	-	-

Table 49. Site M2 (Summer): Distances to PTS onset for marine mammal hearing groups (NMFS 2018) thresholds for continuous sounds generated by relief drilling during piling for attenuation 12 dB.

Hearing group	Frequency-weighted $L_{E,24hr}$ (dB re 1 µPa²·s)	Drilling		
		24 hr		
		R_{max} (km)	$R_{95\%}$ (km)	Area (km²)
Low-frequency (LF) cetaceans	199	<0.05	<0.05	0.005
Mid-frequency (MF) cetaceans	198	-	-	-
High-frequency (HF) cetaceans	173	<0.05	<0.05	0.005
Phocid pinnipeds in water (PPW)	201	-	-	-

Table 50. Site J1 (Summer): Distances to behavioral thresholds for marine mammal hearing groups (NMFS 2018) and sea turtles for continuous sounds generated by relief drilling during piling.

Hearing group	Unweighted L_p (dB re 1 µPa)	0 dB			10 dB			12 dB		
		R_{max} (km)	$R_{95\%}$ (km)	Area (km²)	R_{max} (km)	$R_{95\%}$ (km)	Area (km²)	R_{max} (km)	$R_{95\%}$ (km)	Area (km²)
Marine mammals	120	20.73	17.76	972.5	7.498	7.054	162.8	6.003	5.517	100.6

Table 51. Site M1 (Summer): Distances to behavioral thresholds for marine mammal hearing groups (NMFS 2018) and sea turtles for continuous sounds generated by relief drilling during piling.

Hearing group	Unweighted L_p (dB re 1 µPa)	0 dB			10 dB			12 dB		
		R_{max} (km)	$R_{95\%}$ (km)	Area (km²)	R_{max} (km)	$R_{95\%}$ (km)	Area (km²)	R_{max} (km)	$R_{95\%}$ (km)	Area (km²)
Marine mammals	120	21.65	16.62	877.2	7.830	6.853	151.1	6.089	5.435	94.62

Table 52. Site M2 (Summer): Distances to behavioral thresholds for marine mammal hearing groups (NMFS 2018) and sea turtles for continuous sounds generated by relief drilling during piling.

Hearing group	Unweighted L_p (dB re 1 µPa)	0 dB			10 dB			12 dB		
		R_{max} (km)	$R_{95\%}$ (km)	Area (km²)	R_{max} (km)	$R_{95\%}$ (km)	Area (km²)	R_{max} (km)	$R_{95\%}$ (km)	Area (km²)
Marine mammals	120	25.37	19.67	>1000	7.641	6.884	152.1	6.051	5.495	95.79

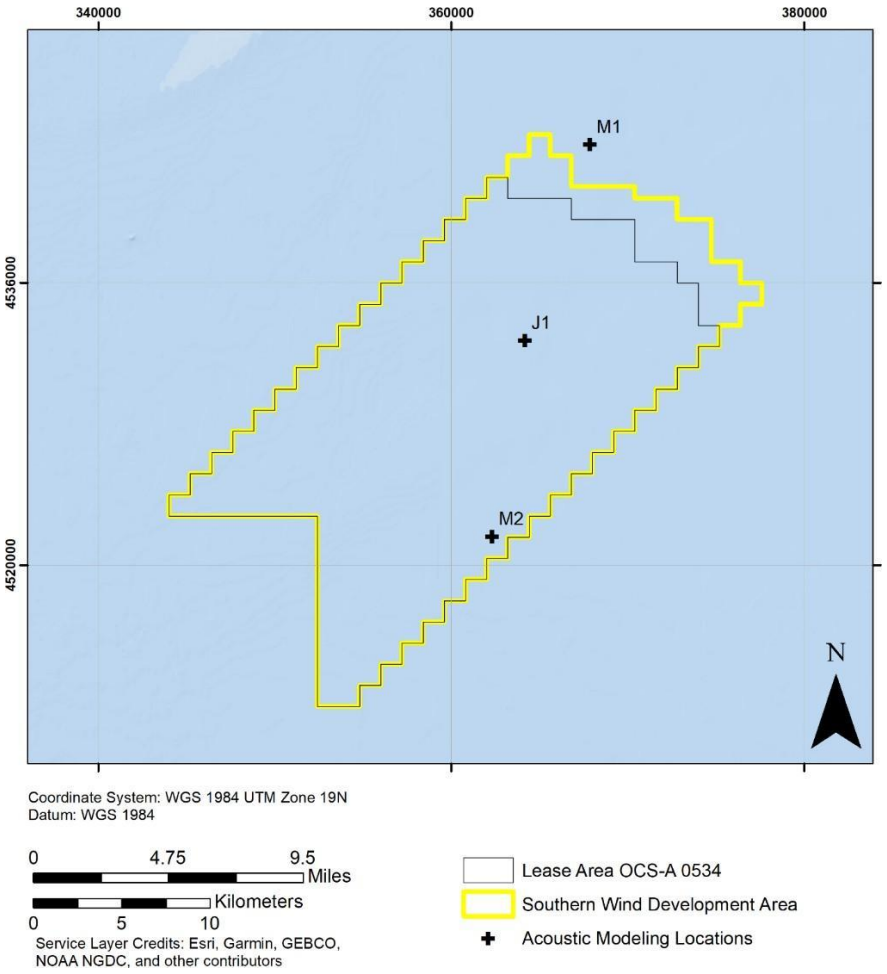

Figure 7. Drilling acoustic modeling locations relative to the Lease Area OCS-A 0534 and the Southern Wind Development Area (SWDA).

3.4. Potential UXO Detonation – Acoustic Ranges

Table 53 presents SEL-based $R_{95\%}$ PTS (Level A) and TTS (Level B) isopleths and their equivalent areas, which include results with no attenuation and results with an assumed 10 dB of attenuation due to the use of NMS (Bellmann 2021). New England Wind will use NAS with an expected 10 dB of attenuation (Bellmann 2021). (No changes from Appendix J memo.)

Table 53. SEL-based criteria ranges (m) and equivalent areas (km^2) to PTS- and TTS-onset ($R_{95\%}$) for various water depths assuming no attenuation and 10 dB attenuation.

Hearing group	Threshold (dB re 1 µPa^{2}s)	No attenuation				10 dB of attenuation			
		12 m	20 m	30 m	45 m	12 m	20 m	30 m	45 m
Radii									
Level A (PTS-onset)									
LF	183	7,640	8,800	8,440	8,540	3,220	3,780	3,610	3,610
MF	185	1,540	1,450	1,480	1,410	461	386	412	412
HF	155	11,300	11,000	10,700	10,900	6,200	6,190	6,190	6,160
PW	185	4,340	4,500	4,450	4,520	1,600	1,430	1,480	1,350
Level B (TTS-onset)									
LF	168	18,300	19,200	19,300	19,000	11,000	11,900	11,500	11,800
MF	170	5,860	5,850	5,840	5,810	2,550	2,430	2,480	2,480
HF	140	20,200	20,200	20,200	20,000	14,100	13,800	13,300	13,700
PW	170	13,300	13,200	12,800	13,300	6,750	6,990	6,900	7,020
Area									
Level A (PTS-onset)									
LF	183	183.37	243.28	223.79	229.12	32.57	44.89	40.94	40.94
MF	185	7.45	6.61	6.88	6.25	0.67	0.47	0.53	0.53
HF	155	401.15	380.13	359.68	373.25	120.76	120.37	120.37	119.21
PW	185	59.17	63.62	62.21	64.18	8.04	6.42	6.88	5.73
Level B (TTS-onset)									
LF	168	1,052.09	1,158.12	1,170.21	1,134.11	380.13	444.88	415.48	437.44
MF	170	107.88	107.51	107.15	106.05	20.43	18.55	19.32	19.32
HF	140	1,281.90	1,281.90	1,281.90	1,256.64	624.58	598.28	555.72	589.65
PW	170	555.72	547.39	514.72	555.72	143.14	153.50	149.57	154.82

Source: Hannay and Zykov (2022)
LF = low-frequency cetaceans; MF = mid-frequency cetaceans; HF = high-frequency cetaceans; PW = phocid pinnipeds in water

4. Exposure Estimates

4.1. Vibratory Pile Setting Followed by Impact Pile Driving and Impact Pile Driving Only – Exposure Estimates

This section contains marine mammal mean exposure estimates for each of the proposed construction schedules described in Section 1.3. Exposure estimates are shown assuming 0,10, and 12 dB of broadband attenuation. Each construction schedule includes a combination of pile sizes (4, 12, and 13 m), foundation types (monopiles or jackets), and installation methods (either vibratory setting of piles followed by impact pile driving or impact pile driving alone). The following tables provide consolidated, project-level exposure estimate summaries from Construction Schedules A and B.

4.1.1. Marine Mammals

This section includes marine mammal exposure estimates for Construction Schedules A and B, both combined and per year, and assuming 0-, 10-, and 12-dB broadband attenuation.

Table 54. Construction Schedule A, All Years Summed: The mean number of marine mammals predicted to receive sound levels above exposure criteria with sound attenuation. Summed construction schedule assumptions are summarized in Section 1.3.

Species		Injury						Behavior					
		L_E			L_{pk}			L_p [a]			L_p [b]		
		Attenuation (dB)						Attenuation (dB)					
		0	10	12	0	10	12	0	10	12	0	10	12
LF	Fin whale [c]	44.03	13.33	10.30	0.36	0.02	0.02	472.78	260.87	229.85	91.72	37.41	31.06
	Minke whale (migrating) [b]	146.66	46.43	32.14	0.32	0.09	0.06	1037.42	637.91	618.22	1016.27	640.28	561.23
	Humpback whale	39.57	13.62	10.58	0.16	0.05	0.05	315.34	174.03	153.42	76.11	33.66	28.06
	North Atlantic right whale [c]	8.86	2.69	1.97	0.03	0	0	103.80	50.08	37.41	23.54	9.89	8.23
	Sei whale [c] (migrating)[b]	7.41	1.79	1.17	0.03	<0.01	<0.01	53.71	30.63	27.39	64.35	34.86	30.62
MF	Atlantic white sided dolphin	0	0	0	0.39	0	0	3875.42	2239.68	1994.30	520.80	222.62	189.13
	Atlantic spotted dolphin	0	0	0	<0.01	0	0	444.67	217.30	188.56	15.17	5.71	4.82
	Common dolphin	0	0	0	9.91	0	0	61093.16	36917.57	33402.10	6899.36	3204.79	2727.81
	Bottlenose dolphin, offshore	0	0	0	0	0	0	4513.50	2560.58	1892.11	390.87	165.39	136.62
	Risso's dolphin	0	0	0	<0.01	0	0	1022.69	568.94	220.72	36.54	16.66	14.04
	Long-finned pilot whale	0	0	0	<0.01	0	0	458.17	269.65	210.75	47.79	21.71	18.58
	Short-finned pilot whale	0	0	0	0	0	0	0	0	0	0	0	0
	Sperm whale [c]	0	0	0	0	0	0	129.49	76.04	67.80	11.08	4.50	3.76
HF	Harbor porpoise (sensitive)[b]	0.83	0	0	35.23	7.11	2.06	2174.93	1202.72	1055.52	3038.18	1548.37	1314.11
PPW	Gray seal	4.83	0.37	0.08	0.04	0	0	3686.44	1465.82	1271.88	210.54	69.76	54.62
	Harbor seal	11.61	0.07	0	0.76	0.04	0	4294.89	794.75	682.26	256.49	100.43	82.75
	Harp seal	12.51	0.34	0.02	1.04	0.02	0.02	4473.69	1927.81	1696.25	270.29	101.52	82.72

[a] NOAA (2005), [b] Wood et al. (2012), [c] Listed as Endangered under the ESA

Table 55. Construction Schedule A, Year 2: The mean number of marine mammals predicted to receive sound levels above exposure criteria with sound attenuation. Yearly construction schedule assumptions are summarized in Section 1.3.

Species		Injury						Behavior					
		L_E			L_{pk}			L_p [a]			L_p [b]		
		Attenuation (dB)						Attenuation (dB)					
		0	10	12	0	10	12	0	10	12	0	10	12
LF	Fin whale [c]	21.33	5.57	4.16	0.14	<0.01	<0.01	211.35	108.46	93.63	57.49	22.43	18.61
	Minke whale (migrating) [b]	67.21	16.88	10.49	0.06	<0.01	<0.01	486.41	284.57	246.68	565.54	367.74	320.93
	Humpback whale	18.64	5.58	4.08	0.06	0.02	0.02	145.87	75.24	64.86	44.60	19.02	15.81
	North Atlantic right whale [c]	3.95	0.98	0.65	0.01	0	0	46.11	19.36	16.53	13.40	5.39	4.48
	Sei whale [c] (migrating)[b]	2.85	0.54	0.30	<0.01	<0.01	<0.01	23.56	12.02	10.38	35.37	19.08	16.66
MF	Atlantic white sided dolphin	0	0	0	0.07	0	0	1787.03	951.70	824.83	257.48	100.09	83.31
	Atlantic spotted dolphin	0	0	0	0	0	0	185.04	81.79	68.41	7.20	2.30	1.83
	Common dolphin	0	0	0	2.84	0	0	25378.05	13739.47	12057.22	3119.00	1348.86	1112.79
	Bottlenose dolphin, offshore	0	0	0	0	0	0	1814.21	897.08	669.71	176.93	67.63	54.98
	Risso's dolphin	0	0	0	<0.01	0	0	393.54	168.60	79.33	16.65	6.97	5.77
	Long-finned pilot whale	0	0	0	<0.01	0	0	201.64	105.51	84.82	23.21	9.65	8.05
	Short-finned pilot whale	0	0	0	0	0	0	0	0	0	0	0	0
	Sperm whale [c]	0	0	0	0	0	0	52.32	28.33	24.63	5.50	2.04	1.65
HF	Harbor porpoise (sensitive)[b]	0.08	0	0	13.95	1.58	0.69	965.28	485.64	417.48	1772.12	882.22	740.82
PPW	Gray seal	1.20	0.01	<0.01	<0.01	0	0	1758.66	593.10	501.22	134.20	43.61	33.71
	Harbor seal	2.03	<0.01	0	0.28	0.04	0	1842.37	333.67	280.31	145.44	54.23	44.08
	Harp seal	2.97	<0.01	0	0.44	<0.01	<0.01	2006.36	715.48	606.98	162.58	57.82	46.48

[a] NOAA (2005), [b] Wood et al. (2012), [c] Listed as Endangered under the ESA

Table 56. Construction Schedule A, Year 3: The mean number of marine mammals predicted to receive sound levels above exposure criteria with sound attenuation. Yearly construction schedule assumptions are summarized in Section 1.3.

Species		Injury						Behavior					
		L_E			L_{pk}			L_p [a]			L_p [b]		
		Attenuation (dB)						Attenuation (dB)					
		0	10	12	0	10	12	0	10	12	0	10	12
LF	Fin whale [c]	22.70	7.75	6.15	0.22	0.02	0.02	261.42	152.41	136.22	34.22	14.98	12.46
	Minke whale (migrating)[b]	79.46	29.55	21.65	0.26	0.08	0.06	551.00	353.33	371.53	450.73	272.53	240.30
	Humpback whale	20.93	8.04	6.50	0.10	0.03	0.03	169.47	98.79	88.56	31.51	14.64	12.25
	North Atlantic right whale [c]	4.91	1.71	1.31	0.02	0	0	57.69	30.72	20.87	10.14	4.49	3.75
	Sei whale [c] (migrating)[b]	4.56	1.25	0.87	0.03	<0.01	<0.01	30.15	18.61	17.01	28.98	15.77	13.96
MF	Atlantic white sided dolphin	0	0	0	0.32	0	0	2088.39	1287.99	1169.46	263.33	122.53	105.81
	Atlantic spotted dolphin	0	0	0	<0.01	0	0	259.64	135.51	120.15	7.96	3.41	2.99
	Common dolphin	0	0	0	7.07	0	0	35715.11	23178.10	21344.89	3780.36	1855.93	1615.02
	Bottlenose dolphin, offshore	0	0	0	0	0	0	2699.29	1663.50	1222.40	213.95	97.76	81.64
	Risso's dolphin	0	0	0	<0.01	0	0	629.15	400.34	141.39	19.89	9.69	8.27
	Long-finned pilot whale	0	0	0	0	0	0	256.53	164.14	125.92	24.58	12.06	10.54
	Short-finned pilot whale	0	0	0	0	0	0	0	0	0	0	0	0
	Sperm whale [c]	0	0	0	0	0	0	77.16	47.71	43.17	5.58	2.47	2.10
HF	Harbor porpoise (sensitive)[b]	0.74	0	0	21.28	5.52	1.37	1209.65	717.07	638.03	1266.06	666.15	573.30
PPW	Gray seal	3.63	0.36	0.08	0.04	0	0	1927.78	872.72	770.66	76.34	26.15	20.90
	Harbor seal	9.59	0.07	0	0.49	0	0	2452.52	461.08	401.95	111.05	46.20	38.66
	Harp seal	9.54	0.33	0.02	0.60	0.02	0.02	2467.33	1212.34	1089.27	107.71	43.70	36.24

[a] NOAA (2005), [b] Wood et al. (2012), [c] Listed as Endangered under the ESA

Table 57. Construction Schedule B, All Years Summed: The mean number of marine mammals predicted to receive sound levels above exposure criteria with sound attenuation. Summed construction schedule assumptions are summarized in Section 1.3.

Species		Injury						Behavior					
		L_E			L_{pk}			L_p [a]			L_p [b]		
		Attenuation (dB)						Attenuation (dB)					
		0	10	12	0	10	12	0	10	12	0	10	12
LF	Fin whale [c]	88.78	31.35	24.69	0.87	0.07	0.07	616.59	347.50	309.57	129.71	55.16	46.41
	Minke whale (migrating)[b]	361.86	138.78	102.32	1.41	0.39	0.33	1622.84	1007.39	1042.06	1833.05	1065.90	941.44
	Humpback whale	70.22	27.60	22.32	0.27	0.12	0.12	422.66	245.91	219.88	105.75	47.56	40.14
	North Atlantic right whale [c]	13.76	4.95	3.78	0.06	0	0	132.41	71.88	46.61	24.74	11.24	9.41
	Sei whale [c] (migrating)[b]	14.38	3.92	2.69	0.07	<0.01	<0.01	78.71	48.74	44.41	82.55	45.65	40.55
MF	Atlantic white sided dolphin	0	0	0	1.09	0	0	5478.74	3425.59	3098.86	852.20	401.24	347.79
	Atlantic spotted dolphin	0	0	0	<0.01	0	0	453.27	224.87	198.71	15.18	6.35	5.53
	Common dolphin	0	0	0	19.56	0	0	76657.61	48805.44	44637.76	10524.50	5125.28	4436.83
	Bottlenose dolphin, offshore	0	0	0	0	0	0	6071.07	3620.53	2701.94	697.57	317.82	265.97
	Risso's dolphin	0	0	0	<0.01	0	0	1197.86	696.11	273.48	54.36	26.25	22.47
	Long-finned pilot whale	0	0	0	0	0	0	592.24	368.00	289.11	78.58	38.68	33.91
	Short-finned pilot whale	0	0	0	0	0	0	0	0	0	0	0	0
	Sperm whale [c]	0	0	0	0	0	0	157.33	95.27	85.61	16.12	7.03	5.96
HF	Harbor porpoise (sensitive)[b]	1.49	0	0	61.00	15.51	3.70	2805.23	1592.22	1412.82	3748.45	1779.99	1537.92
PPW	Gray seal	10.15	1.01	0.23	0.11	0	0	4414.50	2034.39	1798.65	156.93	53.12	42.68
	Harbor seal	26.22	0.20	0	1.27	0	0	5643.75	1070.90	936.80	251.90	108.70	91.35
	Harp seal	26.72	0.88	0.04	1.84	0.08	0.08	5634.83	2839.51	2552.20	239.54	98.93	82.44

[a] NOAA (2005), [b] Wood et al. (2012), [c] Listed as Endangered under the ESA

Table 58. Construction Schedule B, Year 2: The mean number of marine mammals predicted to receive sound levels above exposure criteria with sound attenuation. Yearly construction schedule assumptions are summarized in Section 1.3.

Species		Injury						Behavior					
		L_E			L_{pk}			L_p [a]			L_p [b]		
		Attenuation (dB)						Attenuation (dB)					
		0	10	12	0	10	12	0	10	12	0	10	12
LF	Fin whale [c]	16.01	4.24	3.14	0.12	0.01	0.01	172.78	91.43	80.10	41.52	16.37	13.64
	Minke whale (migrating) [b]	57.17	15.02	9.44	0.03	0.01	<0.01	409.27	259.13	232.48	466.43	306.23	267.91
	Humpback whale	13.55	3.99	3.01	0.03	<0.01	<0.01	112.66	62.63	54.98	33.05	13.50	11.32
	North Atlantic right whale [c]	2.60	0.75	0.50	<0.01	0	0	34.67	13.21	11.02	8.56	3.45	2.89
	Sei whale [c] (migrating) [b]	1.98	0.41	0.24	<0.01	<0.01	<0.01	16.52	8.99	7.95	23.29	12.10	10.67
MF	Atlantic white sided dolphin	0	0	0	0.14	0	0	1310.28	754.22	665.59	178.71	70.41	58.44
	Atlantic spotted dolphin	0	0	0	<0.01	0	0	116.71	45.03	39.22	3.16	1.15	0.96
	Common dolphin	0	0	0	1.75	0	0	17662.30	9842.10	8842.97	1894.47	835.28	697.94
	Bottlenose dolphin, offshore	0	0	0	0	0	0	1368.33	656.25	544.67	117.64	45.81	37.19
	Risso's dolphin	0	0	0	<0.01	0	0	310.14	94.69	61.60	9.72	4.12	3.45
	Long-finned pilot whale	0	0	0	0	0	0	155.52	79.13	67.93	15.50	6.52	5.50
	Short-finned pilot whale	0	0	0	0	0	0	0	0	0	0	0	0
	Sperm whale [c]	0	0	0	0	0	0	40.51	23.63	20.84	3.50	1.33	1.08
HF	Harbor porpoise (sensitive) [b]	0.09	0	0	9.78	1.06	0.59	750.42	391.52	340.89	1171.48	574.76	487.87
PPW	Gray seal	0.79	0.02	<0.01	<0.01	0	0	1350.80	297.91	257.96	83.94	28.40	22.53
	Harbor seal	1.97	<0.01	0	0.29	0	0	1531.78	268.75	228.98	92.90	34.57	28.53
	Harp seal	2.44	0.03	<0.01	0.29	<0.01	<0.01	1549.89	378.60	332.05	99.85	37.32	30.28

[a] NOAA (2005), [b] Wood et al. (2012), [c] Listed as Endangered under the ESA

Table 59. Construction Schedule B, Year 3: The mean number of marine mammals predicted to receive sound levels above exposure criteria with sound attenuation. Yearly construction schedule assumptions are summarized in Section 1.3.

Species		Injury						Behavior					
		L_E			L_{pk}			L_p [a]			L_p [b]		
		Attenuation (dB)						Attenuation (dB)					
		0	10	12	0	10	12	0	10	12	0	10	12
LF	Fin whale [c]	51.85	19.32	15.36	0.53	0.04	0.04	326.71	188.88	169.31	62.68	27.57	23.29
	Minke whale (migrating) [b]	211.37	85.85	64.43	0.95	0.26	0.22	839.68	517.67	559.96	947.80	526.86	467.12
	Humpback whale	39.62	16.51	13.50	0.17	0.08	0.08	216.17	127.85	115.03	50.79	23.79	20.13
	North Atlantic right whale [c]	7.64	2.88	2.24	0.03	0	0	67.49	40.53	24.65	11.08	5.33	4.46
	Sei whale [c] (migrating)[b]	8.36	2.36	1.65	0.05	<0.01	<0.01	41.03	26.18	24.00	40.07	22.69	20.21
MF	Atlantic white sided dolphin	0	0	0	0.66	0	0	2869.87	1838.83	1674.83	470.37	231.05	202.09
	Atlantic spotted dolphin	0	0	0	<0.01	0	0	257.23	137.43	121.90	8.34	3.60	3.16
	Common dolphin	0	0	0	12.35	0	0	42868.60	28373.15	26087.33	6024.85	2995.08	2611.11
	Bottlenose dolphin, offshore	0	0	0	0	0	0	3427.15	2164.30	1577.88	410.82	192.70	162.06
	Risso's dolphin	0	0	0	0	0	0	675.54	458.24	158.83	31.24	15.49	13.31
	Long-finned pilot whale	0	0	0	0	0	0	317.23	210.13	160.61	44.56	22.71	20.06
	Short-finned pilot whale	0	0	0	0	0	0	0	0	0	0	0	0
	Sperm whale [c]	0	0	0	0	0	0	88.08	54.21	49.03	8.96	4.04	3.47
HF	Harbor porpoise (sensitive) [b]	1.02	0	0	35.56	10.03	2.17	1458.63	863.37	771.07	1816.40	844.18	735.44
PPW	Gray seal	6.37	0.67	0.15	0.08	0	0	2084.65	1181.15	1047.92	49.85	16.89	13.77
	Harbor seal	16.51	0.13	0	0.67	0	0	2799.71	529.17	466.88	108.63	50.65	42.92
	Harp seal	16.55	0.57	0.02	1.06	0.06	0.06	2780.81	1674.77	1510.86	95.42	42.10	35.64

[a] NOAA (2005), [b] Wood et al. (2012), [c] Listed as Endangered under the ESA

Table 60. Construction Schedule B, Year 4: The mean number of marine mammals predicted to receive sound levels above exposure criteria with sound attenuation. Yearly construction schedule assumptions are summarized in Section 1.3.

Species		Injury						Behavior					
		L_E			L_{pk}			L_p [a]			L_p [b]		
		Attenuation (dB)						Attenuation (dB)					
		0	10	12	0	10	12	0	10	12	0	10	12
LF	Fin whale [c]	20.92	7.79	6.19	0.21	0.02	0.02	117.11	67.19	60.16	25.51	11.22	9.48
	Minke whale (migrating)[b]	93.33	37.91	28.45	0.42	0.12	0.10	373.89	230.59	249.62	418.83	232.81	206.41
	Humpback whale	17.04	7.10	5.81	0.07	0.03	0.03	93.82	55.43	49.86	21.91	10.26	8.69
	North Atlantic right whale [c]	3.51	1.32	1.03	0.02	0	0	30.25	18.14	10.94	5.11	2.46	2.06
	Sei whale [c] (migrating)[b]	4.04	1.14	0.80	0.02	<0.01	<0.01	21.16	13.57	12.46	19.19	10.86	9.68
MF	Atlantic white sided dolphin	0	0	0	0.29	0	0	1298.59	832.54	758.44	203.12	99.77	87.26
	Atlantic spotted dolphin	0	0	0	<0.01	0	0	79.33	42.41	37.59	3.68	1.60	1.40
	Common dolphin	0	0	0	5.45	0	0	16126.71	10590.19	9707.46	2605.18	1294.92	1127.78
	Bottlenose dolphin, offshore	0	0	0	0	0	0	1275.59	799.98	579.39	169.11	79.31	66.71
	Risso's dolphin	0	0	0	0	0	0	212.18	143.19	53.05	13.40	6.64	5.71
	Long-finned pilot whale	0	0	0	0	0	0	119.49	78.75	60.58	18.52	9.44	8.34
	Short-finned pilot whale	0	0	0	0	0	0	0	0	0	0	0	0
	Sperm whale [c]	0	0	0	0	0	0	28.74	17.44	15.74	3.66	1.65	1.41
HF	Harbor porpoise (sensitive)[b]	0.39	0	0	15.65	4.42	0.95	596.18	337.33	300.86	760.57	361.05	314.61
PPW	Gray seal	2.99	0.32	0.07	0.03	0	0	979.05	555.33	492.76	23.13	7.83	6.38
	Harbor seal	7.74	0.06	0	0.31	0	0	1312.26	272.98	240.95	50.37	23.49	19.90
	Harp seal	7.73	0.28	0.01	0.48	0.02	0.02	1304.14	786.14	709.29	44.27	19.51	16.51

[a] NOAA (2005), [b] Wood et al. (2012), [c] Listed as Endangered under the ESA

4.1.2. Effect of Aversion

Table 61. Comparison of mean exposure estimates modeled for Construction Schedule A (all years summed) for harbor porpoises and North Atlantic right whales (NARWs) when aversion is included in animal movement models relative to models without aversion, assuming 10 dB attenuation.

Species	10 dB attenuation, no aversion				10 dB attenuation, with aversion			
	Injury		Behavior		Injury		Behavior	
	L_E	L_{pk}	L_p	L_p	L_E	L_{pk}	L_p	L_p
North Atlantic right whale	2.69	0	50.08	9.89	0.49	0	41.94	7.83
Harbor porpoise	0	7.11	1202.72	1548.37	0	0	802.52	1071.67

4.2. Drilling – Exposure Estimates

Table 62. Pile Installation Construction Schedule A: Estimated number of Level B exposures [a] from drilling during pile installation by year and for the full 2-year pile installation schedule. (Site J1 had the highest exposure estimates so all values come from J1).

Species		Year 2 (2026)	Year 3 (2027)	All years combined
LF	Fin whale [b]	15.13	6.18	21.32
	Minke whale	38.79	16.85	55.64
	Humpback whale	10.23	4.75	14.98
	North Atlantic right whale [b]	2.59	1.32	3.90
	Sei whale [a,b]	1.92	1.03	2.95
MF	Atlantic white-sided dolphin	93.80	43.60	137.40
	Atlantic spotted dolphin	7.42	3.43	10.85
	Common dolphin	877.24	377.50	1254.74
	Bottlenose dolphin, offshore	77.19	34.63	111.82
	Risso's dolphin	5.73	2.55	8.28
	Long-finned pilot whale	10.16	4.62	14.78
	Short-finned pilot whale	2.54	1.15	3.70
	Sperm whale [b]	3.17	1.45	4.62
HF	Harbor porpoise	71.60	34.46	106.06
PPW	Gray seal	33.81	19.32	53.13
	Harbor seal	50.72	28.97	79.69
	Harp seal	36.23	20.70	56.92

[a] Estimated exposures are from the full drilling schedule; final take request does not include drilling exposures on days when both vibratory setting and drilling occur on the same day to avoid double counting. A total of 17 days (8 days in Year 1, 9 days in Year 2) of drilling exposures in Construction Schedule A were not included in the final take request.

[b] Listed as Endangered under the ESA.

Table 63. Pile Installation Construction Schedule B: Estimated number of Level B exposures [a] from drilling during pile installation by year and for the full 3-year pile installation schedule. (Site J1 had the highest exposure estimates so all values come from J1).

Species		Year 2 (2026)	Year 3 (2027)	All years combined	Year 2 (2026)
LF	Fin whale [b]	8.83	9.01	3.85	21.69
	Minke whale	27.73	25.30	12.87	65.90
	Humpback whale	6.74	6.16	3.20	16.10
	North Atlantic right whale [b]	1.97	1.44	0.98	4.40
	Sei whale [b]	1.47	1.12	0.76	3.35
MF	Atlantic white-sided dolphin	63.53	56.43	30.47	150.43
	Atlantic spotted dolphin	4.19	3.51	1.73	9.43
	Common dolphin	515.72	485.77	210.11	1211.60
	Bottlenose dolphin, offshore	45.58	44.48	19.90	109.95
	Risso's dolphin	3.30	3.11	1.34	7.74
	Long-finned pilot whale	6.16	5.85	2.77	14.78
	Short-finned pilot whale	1.54	1.46	0.69	3.70
	Sperm whale [b]	1.80	1.75	0.67	4.22
HF	Harbor porpoise	50.91	39.30	24.34	114.54
PPW	Gray seal	27.62	19.27	14.80	61.69
	Harbor seal	41.43	28.91	22.20	92.54
	Harp seal	29.59	20.65	15.86	66.10

[a] Estimated exposures are from the full drilling schedule; final take request does not include drilling exposures on days when both vibratory setting and drilling occur on the same day to avoid double counting. A total of 13 days (9 in Year 1, 2 in Year 2, and 2 in Year 3) of drilling exposures in Construction Schedule B were not included in the final take request.

[b] Listed as Endangered under the ESA.

4.3. Potential UXO Detonation – Exposure Estimates

Table 64. Estimated potential maximum Level A exposures of marine mammals resulting from the possible detonations of up to 10 total UXOs occurring in 2025 and 2026, assuming no attenuation and 10 dB of attenuation.

Species		Estimated Level A Exposures (PTS SEL)			
		No Attenuation [c]		10 dB of Attenuation	
		Year 1 (2025) [d]	Year 2 (2026) [e]	Year 1 (2025) [d]	Year 2 (2026) [e]
LF	Fin whale [a]	4.08	3.85	0.75	0.70
	Minke whale	16.88	15.58	3.10	2.82
	Humpback whale	2.98	2.69	0.55	0.49
	North Atlantic right whale [a,b]	7.17	6.40	1.32	1.16
	Sei whale [a]	1.94	1.73	0.36	0.31
MF	Atlantic white-sided dolphin	0.88	0.86	0.06	0.07
	Atlantic spotted dolphin	0.12	0.12	0.01	0.01
	Common dolphin	6.69	6.52	0.49	0.53
	Bottlenose dolphin, offshore	0.46	0.43	0.03	0.03
	Risso's dolphin	0.05	0.05	0.00	0.00
	Long-finned pilot whale	0.04	0.04	0.00	0.00
	Short-finned pilot whale	0.03	0.03	0.00	0.00
	Sperm whale [a]	0.03	0.03	0.00	0.00
HF	Harbor porpoise	374.31	345.46	55.36	50.83
PPW	Gray seal [b]	63.54	34.50	7.51	3.44
	Harbor seal [b]	142.75	77.51	16.87	7.73
	Harp seal [b]	63.54	34.50	7.51	3.44

[a] Listed as Endangered under the ESA.
[b] Level A exposures were estimated for this species, but due to mitigation measures, no Level A takes are expected or requested.
[c] Although the Proponent intends to use mitigation during all potential UXO detonations, values assuming no attenuation are presented here for comparison.
[d] Year 1 (2025) exposures are calculated under the assumption that 2 UXOs would be detonated at the 12 m water depth location, 3 UXOs at 20 m, 1 UXO at 30 m, and 0 UXOs at 40 m. A total of 6 UXOs are assumed in this year.
[e] Year 2 (2026) exposures are calculated under the assumption that 0 UXOs would be detonated at the 12 m water depth location, 0 UXOs at 20 m, 2 UXOs at 30 m, and 2 UXOs at 40 m. A total of 4 UXOs are assumed in this year.

Table 65. Estimated potential maximum Level B exposures of marine mammals resulting from the possible detonations of up to 10 total UXOs occurring in 2025 and 2026, assuming no attenuation and 10 dB of attenuation.

Species		Estimated Level B Exposures (TTS SEL)			
		No Attenuation [b]		10 dB of Attenuation	
		Year 1 (2025) [c]	Year 2 (2026) [d]	Year 1 (2025) [c]	Year 2 (2026) [d]
LF	Fin whale [a]	15.82	15.75	6.75	6.56
	Minke whale	65.73	63.69	27.98	26.52
	Humpback whale	11.65	10.99	4.95	4.58
	North Atlantic right whale [a]	35.27	32.57	13.25	12.06
	Sei whale [a]	7.63	7.07	3.24	2.94
MF	Atlantic white-sided dolphin	13.31	13.12	2.41	2.46
	Atlantic spotted dolphin	1.83	1.79	0.33	0.34
	Common dolphin	100.82	99.41	18.28	18.67
	Bottlenose dolphin, offshore	6.89	6.52	1.25	1.23
	Risso's dolphin	0.73	0.70	0.13	0.13
	Long-finned pilot whale	0.54	0.54	0.10	0.10
	Short-finned pilot whale	0.40	0.40	0.07	0.07
	Sperm whale [a]	0.46	0.45	0.08	0.08
HF	Harbor porpoise	1031.91	952.37	216.13	192.18
PPW	Gray seal [b]	503.19	257.67	145.91	79.64
	Harbor seal [b]	1130.53	578.92	327.81	178.93
	Harp seal [b]	503.19	257.67	145.91	79.64

[a] Listed as Endangered under the ESA.
[b] Although the Proponent intends to use mitigation during all potential UXO detonations, values assuming no attenuation are presented here for comparison.
[c] Year 1 (2025) exposures are calculated under the assumption that 2 UXOs would be detonated at the 12 m water depth location, 3 UXOs at 20 m, 1 UXO at 30 m, and 0 UXOs at 40 m. A total of 6 UXOs are assumed in this year.
[d] Year 2 (2026) exposures are calculated under the assumption that 0 UXOs would be detonated at the 12 m water depth location, 0 UXOs at 20 m, 2 UXOs at 30 m, and 2 UXOs at 40 m. A total of 4 UXOs are assumed in this year.

4.4. HRG Surveys – Exposure Estimates

Table 66. Number of animals of each species estimated to receive sound levels above the Level B threshold annually during HRG surveys of New England Wind for the two different equipment types.

Species		Applied Acoustics AA251 boomer	GeoMarine Geo Spark 2000
LF	Fin whale [a]	3.11	2.47
	Minke whale	12.17	9.64
	Humpback whale	2.31	1.83
	North Atlantic right whale [a]	4.05	3.21
	Sei whale [a]	1.38	1.09
MF	Atlantic white-sided dolphin	24.34	19.26
	Atlantic spotted dolphin	2.88	2.28
	Common dolphin	202.30	160.13
	Bottlenose dolphin, offshore	12.53	9.92
	Risso's dolphin	1.34	1.06
	Long-finned pilot whale	1.06	0.84
	Short-finned pilot whale	0.78	0.62
	Sperm whale [a]	0.79	0.62
HF	Harbor porpoise	78.41	62.07
PPW	Gray seal	199.35	157.80
	Harbor seal	447.89	354.54
	Harp seal	199.35	157.80

[a] Listed as Endangered under the ESA.

5. Take Estimates

5.1. Vibratory Pile Setting Followed by Impact Pile Driving and Impact Pile Driving Only – Take Estimates

This section contains marine mammal take estimates for each of the proposed construction schedules described in Section 1.2. Take estimates are shown assuming 10 and 12 dB of broadband attenuation. Each construction schedule includes a combination of foundations installed with vibratory setting of piles followed by impact pile driving and foundations installed with impact pile driving alone (see Section 4.1).

Table 67. Construction Schedule A: Number of Level A and Level B takes [a] calculated for modeled species for vibratory setting followed by impact pile driving and impact pile driving only using model results with 10- or 12-dB sound attenuation for comparison.

Species		Year 2 (2026)				Year 3 (2027)				All years combined [d]			
		Level A		Level B		Level A		Level B		Level A		Level B	
		Attenuation (dB)				Attenuation (dB)				Attenuation (dB)			
		10	12	10	12	10	12	10	12	10	12	10	12
LF	Fin whale [b]	6	5	109	94	8	7	153	137	14	12	262	231
	Minke whale	17	11	285	247	30	22	354	372	47	33	639	619
	Humpback whale	6	5	76	65	9	7	99	89	15	12	175	154
	North Atlantic right whale [b,c]	1	1	20	17	2	2	31	21	3	3	51	38
	Sei whale [b]	1	1	13	11	2	1	19	18	3	2	32	29
MF	Atlantic white sided dolphin	0	0	952	825	0	0	1288	1170	0	0	2240	1995
	Atlantic spotted dolphin	0	0	82	69	0	0	136	121	0	0	218	190
	Common dolphin	0	0	13740	12058	0	0	23179	21345	0	0	36919	33403
	Bottlenose dolphin, offshore	0	0	898	670	0	0	1664	1223	0	0	2562	1893
	Risso's dolphin	0	0	169	80	0	0	401	142	0	0	570	222
	Long-finned pilot whale	0	0	106	85	0	0	165	126	0	0	271	211
	Short-finned pilot whale[d]	0	0	9	9	0	0	9	9	0	0	18	18
	Sperm whale [b]	0	0	29	25	0	0	48	44	0	0	77	69
HF	Harbor porpoise	2	1	486	418	6	2	718	639	8	3	1204	1057
PPW	Gray seal	1	1	594	502	1	1	873	771	2	2	1467	1273
	Harbor seal	1	0	334	281	1	0	462	402	2	0	796	683
	Harp seal	1	1	716	607	1	1	1213	1090	2	2	1929	1697

[a] Estimated takes are from the vibratory setting followed by impact pile driving and impact pile driving alone schedule; final take request does not include level B impact pile driving alone takes on days when both impact piling alone and drilling occur on the same day to avoid double counting.
[b] Listed as Endangered under the ESA.
[c] Level A exposures were estimated for this species, but due to mitigation measures, no Level A takes are expected or requested.
[d] Annual Level B take estimate increased to one average group size, total take estimate increased to three average group sizes.
[e] All take estimates are displayed as whole numbers. Summed values (all years combined) may differ from summing the displayed values of the individual years because the displayed sums are rounded after the underlying addition is performed (e.g., 7.7 + 8.6 = 16.3, is displayed as 8 + 9 = 16).

Table 68. Construction Schedule B: Number of Level A and Level B takes [a] calculated for modeled species for impact pile driving using model results with 10- or 12-dB sound attenuation for comparison.

Species		Year 2 (2026)				Year 3 (2027)				Year 4 (2028)				All years combined [d]			
		Level A		Level B		Level A		Level B		Level A		Level B		Level A		Level B	
		Attenuation (dB)				Attenuation (dB)				Attenuation (dB)				Attenuation (dB)			
		10	12	10	12	10	12	10	12	10	12	10	12	10	12	10	12
LF	Fin whale [b]	5	4	92	81	20	16	189	170	8	7	68	61	33	27	349	312
	Minke whale	16	10	260	233	86	65	518	560	38	29	231	250	140	104	1009	1043
	Humpback whale	4	4	63	55	17	14	128	116	8	6	56	50	29	24	247	221
	North Atlantic right whale [b,c]	1	1	14	12	3	3	41	25	2	2	19	11	6	6	74	48
	Sei whale [b]	1	1	9	8	3	2	27	25	2	1	14	13	6	4	50	46
MF	Atlantic white sided dolphin	0	0	755	666	0	0	1839	1675	0	0	833	759	0	0	3427	3100
	Atlantic spotted dolphin	0	0	46	40	0	0	138	122	0	0	43	38	0	0	227	200
	Common dolphin	0	0	9843	8843	0	0	28374	26088	0	0	10591	9708	0	0	48808	44639
	Bottlenose dolphin, offshore	0	0	657	545	0	0	2165	1578	0	0	800	580	0	0	3622	2703
	Risso's dolphin	0	0	95	62	0	0	459	159	0	0	144	54	0	0	698	275
	Long-finned pilot whale	0	0	80	68	0	0	211	161	0	0	79	61	0	0	370	290
	Short-finned pilot whale[d]	0	0	9	9	0	0	9	9	0	0	9	9	0	0	27	27
	Sperm whale [b]	0	0	24	21	0	0	55	50	0	0	18	16	0	0	97	87
HF	Harbor porpoise	2	1	392	341	11	3	864	772	5	1	338	301	18	5	1594	1414
PPW	Gray seal	1	1	298	258	1	1	1182	1048	1	1	556	493	3	3	2036	1799
	Harbor seal	1	0	269	229	1	0	530	467	1	0	273	241	3	0	1072	937
	Harp seal	1	1	379	333	1	1	1675	1511	1	1	787	710	3	3	2841	2554

[a] Estimated takes are from the vibratory setting followed by impact pile driving and impact pile driving alone schedule; final take request does not include level B impact pile driving alone takes on days when both impact piling alone and drilling occur on the same day to avoid double counting.
[b] Listed as Endangered under the ESA.
[c] Level A exposures were estimated for this species, but due to mitigation measures, no Level A takes are expected or requested.
[d] Annual Level B take estimate increased to one average group size, total take estimate increased to three average group sizes.

5.2. Drilling – Take Estimates

Table 69. Construction Schedule A: Estimated number of Level B takes [a] from drilling during pile installation by year and for the full 2-year construction schedule assuming drilling is used on 36% of foundation positions.

Species		Year 2 (2026)	Year 3 (2027)	All years [c] combined
LF	Fin whale [b]	16	7	23
	Minke whale	39	17	56
	Humpback whale	11	5	16
	North Atlantic right whale [b]	3	2	5
	Sei whale [b]	2	2	4
MF	Atlantic white-sided dolphin	94	44	138
	Atlantic spotted dolphin	8	4	12
	Common dolphin	878	378	1256
	Bottlenose dolphin, offshore	78	35	113
	Risso's dolphin	6	3	9
	Long-finned pilot whale	11	5	16
	Short-finned pilot whale	3	2	5
	Sperm whale [b]	4	2	6
HF	Harbor porpoise	72	35	107
PPW	Gray seal	34	20	54
	Harbor seal	51	29	80
	Harp seal	37	21	58

[a] Estimated takes are from the full drilling schedule; final take request does not include level B drilling takes on days when both vibratory setting and drilling occur on the same day to avoid double counting.
[b] Listed as Endangered under the ESA.

Table 70. Construction Schedule B: Estimated number of Level B takes [a] from drilling during pile installation by year and for the full 3-year construction schedule assuming drilling is used on 36% of foundation positions.

Species		Year 2 (2026)	Year 3 (2027)	Year 4 (2028)	All years [c] combined
LF	Fin whale [b]	9	10	4	23
	Minke whale	28	26	13	67
	Humpback whale	7	7	4	18
	North Atlantic right whale [b]	2	2	1	5
	Sei whale [b]	2	2	1	5
MF	Atlantic white-sided dolphin	64	57	31	152
	Atlantic spotted dolphin	5	4	2	11
	Common dolphin	516	486	211	1213
	Bottlenose dolphin, offshore	46	45	20	111
	Risso's dolphin	4	4	2	10
	Long-finned pilot whale	7	6	3	16
	Short-finned pilot whale	2	2	1	5
	Sperm whale [b]	2	2	1	5
HF	Harbor porpoise	51	40	25	116
PPW	Gray seal	28	20	15	63
	Harbor seal	42	29	23	94
	Harp seal	30	21	16	67

[a] Estimated takes are from the full drilling schedule; final take request does not include level B drilling takes on days when both vibratory setting and drilling occur on the same day to avoid double counting

[b] Listed as Endangered under the ESA.

Table 71. Level B takes [a] calculated for drilling during pile installation based on the higher of the take estimates from either Schedule A or Schedule B for each species. Used in the final take request. (It is noted that Year 2 all come from Schedule A, while all of Year 3 and Year 4 are from Schedule B).

Species		Level B take			
		Year 2 (2026)	Year 3 (2027)	Year 4 (2028)	3-Year total [c]
LF	Fin whale [b]	16	10	4	30
	Minke whale	39	26	13	78
	Humpback whale	11	7	4	22
	North Atlantic right whale [b]	3	2	1	6
	Sei whale [b]	2	2	1	5
MF	Atlantic white-sided dolphin	94	57	31	182
	Atlantic spotted dolphin	8	4	2	14
	Common dolphin	878	486	211	1575
	Bottlenose dolphin, offshore	78	45	20	143
	Risso's dolphin	6	4	2	12
	Long-finned pilot whale	11	6	3	20
	Short-finned pilot whale	3	2	1	6
	Sperm whale [b]	4	2	1	7
HF	Harbor porpoise	72	40	25	137
PPW	Gray seal	34	20	15	69
	Harbor seal	51	29	23	103
	Harp seal	37	21	16	74

[a] Estimated takes are from the full drilling schedule; final take request does not include level B drilling takes on days when both vibratory setting and drilling occur on the same day to avoid double counting

[b] Listed as Endangered under the ESA.

5.3. Potential UXO Detonation – Take Estimates

Table 72. Estimated Level A and Level B takes resulting from detonation of up to 10 potential UXOs across Year 1 (2025) and Year 2 (2026), assuming no attenuation.

Species		No Attenuation [c]			
		Year 1 (2025)[d]		Year 2 (2026)[e]	
		Level A	Level B	Level A	Level B
LF	Fin whale [a]	5	16	4	16
	Minke whale	17	66	16	64
	Humpback whale	3	12	3	11
	North Atlantic right whale [a,b]	0	36	0	33
	Sei whale [a]	2	8	2	8
MF	Atlantic white-sided dolphin	1	14	1	14
	Atlantic spotted dolphin	1	2	1	2
	Common dolphin	7	101	7	100
	Bottlenose dolphin, offshore	1	7	1	7
	Risso's dolphin	1	1	1	1
	Long-finned pilot whale	1	1	1	1
	Short-finned pilot whale	1	1	1	1
	Sperm whale [a]	1	1	1	1
HF	Harbor porpoise	375	1032	346	953
PPW	Gray seal	64	504	35	258
	Harbor seal	143	1131	78	579
	Harp seal	64	504	35	258

[a] Listed as Endangered under the ESA.
[b] In consultation with BOEM and NMFS, New England Wind will identify appropriate NAS to prohibit all Level A take for North Atlantic right whale.
[c] Although the Proponent intends to use mitigation during all potential UXO detonations, values assuming no attenuation are presented here for comparison.
[d] Year 1 (2025) assumes that 2 UXOs would be detonated at the 12 m water depth location, 3 UXOs at 20 m, 1 UXO at 30 m, and 0 UXOs at 40 m. A total of 6 UXOs are assumed in this year.
[e] Year 2 (2026) assumes that 0 UXOs would be detonated at the 12 m water depth location, 0 UXOs at 20 m, 2 UXOs at 30 m, and 2 UXOs at 40 m. A total of 4 UXOs are assumed in this year.

Table 73. Estimated Level A and Level B takes resulting from detonation of up to 10 potential UXOs across Year 1 (2025) and Year 2 (2026), assuming 10 dB of attenuation.

Species		10 dB of Attenuation						
		Year 1 (2025)[c]		Year 2 (2026)[d]		Year 1 + Year 2[e]		
		Level A	Level B	Level A	Level B	Level A	Level B	Total
LF	Fin whale [a]	1	7	1	7	2	14	16
	Minke whale	4	28	3	27	7	55	62
	Humpback whale	1	5	1	5	2	10	12
	North Atlantic right whale [a,b]	0	14	0	13	0	27	27
	Sei whale [a]	1	4	1	3	2	7	9
MF	Atlantic white-sided dolphin	1	3	1	3	2	6	8
	Atlantic spotted dolphin	1	1	1	1	2	2	4
	Common dolphin	1	19	1	19	2	38	40
	Bottlenose dolphin, offshore	1	2	1	2	2	4	6
	Risso's dolphin	1	1	1	1	2	2	4
	Long-finned pilot whale	1	1	1	1	2	2	4
	Short-finned pilot whale	1	1	1	1	2	2	4
	Sperm whale [a]	1	1	1	1	2	2	4
HF	Harbor porpoise	56	217	51	193	107	410	517
PPW	Gray seal	8	146	4	80	12	226	238
	Harbor seal	17	328	8	179	25	507	532
	Harp seal	8	146	4	80	12	226	238

[a] Listed as Endangered under the ESA.

[b] In consultation with BOEM and NMFS, New England Wind will identify appropriate NAS to prohibit all Level A take for North Atlantic right whale.

[c] Year 1 (2025) assumes that 2 UXOs would be detonated at the 12 m water depth location, 3 UXOs at 20 m, 1 UXO at 30 m, and 0 UXOs at 40 m. A total of 6 UXOs are assumed in this year.

[d] Year 2 (2026) assumes that 0 UXOs would be detonated at the 12 m water depth location, 0 UXOs at 20 m, 2 UXOs at 30 m, and 2 UXOs at 40 m. A total of 4 UXOs are assumed in this year.

[e] All take estimates are displayed as whole numbers. Summed values may differ from summing the displayed values of the individual years because the displayed sums are rounded after the underlying addition is performed (e.g., 7.7 + 8.6 = 16.3, is displayed as 8 + 9 = 16).

5.4. HRG Surveys – Take Estimates

Table 74. Estimated Level B takes from HRG surveys for the effective period of the LOA (5-year total, 2025–2029).

Species		Requested yearly maximum takes	Requested 5-year total maximum takes
LF	Fin whale [a]	4	20
	Minke whale	13	65
	Humpback whale	3	15
	North Atlantic right whale [a]	5	25
	Sei whale [a]	2	10
MF	Atlantic white-sided dolphin [b]	28	140
	Atlantic spotted dolphin [b]	30	150
	Common dolphin	203	1015
	Bottlenose dolphin, offshore [b]	18	90
	Risso's dolphin [b]	7	35
	Long-finned pilot whale [b]	17	85
	Short-finned pilot whale [b]	9	45
	Sperm whale [a,b]	2	10
HF	Harbor porpoise	79	395
PPW	Gray seal	200	1000
	Harbor seal	448	2240
	Harp seal	200	1000

[a] Listed as Endangered under the ESA.
[b] Annual Level B take rounded up to one group size.

6. Number of Takes Requested – All Activities

6.1. Modeled Marine Mammal Species

Table 75. Requested Level A and Level B takes [a] by year for all activities for the effective period of the LOA (5-year total, 2025–2029). Max % is Level A + Level B percentage of population size.

Species		Population Size	Year 1 (2025)[b]			Year 2 (2026)			Year 3 (2027)			Year 4 (2028)			Year 5 (2029)		
			Level A	Level B	Max %	Level A	Level B	Max %	Level A	Level B	Max %	Level A	Level B	Max %	Level A	Level B	Max %
LF	Fin whale [c]	6,802	1	11	0.18	7	122	1.90	20	194	3.15	8	72	1.18	0	4	0.06
	Minke whale	21,968	4	41	0.20	20	305	1.48	86	480	2.58	38	219	1.17	0	13	0.06
	Humpback whale	1,396	1	8	0.64	7	84	6.52	17	129	10.46	8	58	4.73	0	3	0.21
	North Atlantic right whale [c]	338	0	19	5.62	0	39	11.54	0	46	13.61	0	23	6.80	0	5	1.48
	Sei whale [c]	6,292	1	6	0.11	2	17	0.30	3	27	0.48	2	15	0.27	0	2	0.03
MF	Atlantic white-sided dolphin	93,233	1	31	0.03	1	905	0.97	0	1713	1.84	0	788	0.85	0	28	0.03
	Atlantic spotted dolphin	39,921	1	31	0.08	1	116	0.29	0	169	0.42	0	73	0.18	0	30	0.08
	Common dolphin	172,974	1	222	0.13	1	12501	7.23	0	26553	15.35	0	10023	5.79	0	203	0.12
	Bottlenose dolphin, offshore	62,851	1	20	0.03	1	872	1.39	0	2065	3.29	0	772	1.23	0	18	0.03
	Risso's dolphin	35,215	1	8	0.03	1	172	0.49	0	456	1.29	0	147	0.42	0	7	0.02
	Long-finned pilot whale	39,215	1	18	0.05	1	118	0.30	0	216	0.55	0	92	0.23	0	17	0.04
	Short-finned pilot whale	28,924	1	10	0.04	1	21	0.08	0	20	0.07	0	19	0.07	0	9	0.03
	Sperm whale [c]	4,349	1	3	0.09	1	32	0.76	0	56	1.29	0	20	0.46	0	2	0.05
HF	Harbor porpoise	95,543	56	296	0.37	53	755	0.85	11	902	0.96	5	394	0.42	0	79	0.08
PPW	Gray seal	27,300	8	346	1.30	5	887	3.27	1	1391	5.10	1	762	2.79	0	200	0.73
	Harbor seal	61,336	17	776	1.29	9	980	1.61	1	973	1.59	1	718	1.17	0	448	0.73
	Harp seal	7,600,000	8	346	0.00	5	1000	0.01	1	1867	0.02	1	982	0.01	0	200	0.00

[a] Vibratory setting produces longer level B exposure ranges than drilling, and so, on days when both of these pile installation methods occur, level B takes as a result of drilling will already be accounted for in the vibratory setting level B take estimation. Therefore, to avoid double counting level B takes, for days when both vibratory setting and drilling occur, only the vibratory setting level B takes are included. Similarly, drilling produces longer exposure ranges than impact only piling, and so, on days when both drilling and impact only piling occur, to avoid double counting level B takes, only the drilling level B takes are included.

[b] For the purpose of this take request update, Year 1 is assumed to be 2025. These dates reflect the currently projected construction start year and are subject to change because exact project start dates and construction schedules are not currently available.

[c] Listed as Endangered under the ESA.

Table 76. Summary of requested Level A and Level B takes [a] for all activities for the effective period of the LOA (5-year total, 2025–2029).

Species		Population Size	5 Year Total		
			Level A	Level B	Max %
LF	Fin whale [b]	6802	36	403	6.45
	Minke whale	21968	148	1058	5.49
	Humpback whale	1396	33	282	22.56
	North Atlantic right whale [b]	338	0	132	39.05
	Sei whale [b]	6292	8	67	1.19
MF	Atlantic white-sided dolphin	93233	2	3465	3.72
	Atlantic spotted dolphin	39921	2	419	1.05
	Common dolphin	172974	2	49502	28.62
	Bottlenose dolphin, offshore	62851	2	3747	5.96
	Risso's dolphin	35215	2	790	2.25
	Long-finned pilot whale	39215	2	461	1.18
	Short-finned pilot whale	28924	2	79	0.28
	Sperm whale [b]	4349	2	113	2.64
HF	Harbor porpoise	95543	125	2426	2.67
PPW	Gray seal	27300	15	3586	13.19
	Harbor seal	61336	28	3895	6.40
	Harp seal	7600000	15	4395	0.06

[a] For days when pile installation includes both vibratory setting and drilling, only the vibratory setting Level B takes are included (because more takes are predicted for this activity) and not the drilling Level B takes to avoid double counting. For days when pile installation includes both impact pile driving alone and drilling, only the drilling Level B takes are included (because more takes are predicted for this activity) and not the impact pile driving alone Level B takes to avoid double counting.

[b] Listed as Endangered under the ESA.

6.2. Rare Marine Mammal Species

The number of takes requested for each rare marine mammal species by year as well as the total take request for each of these species is provided in Table 77. Yearly number of Level A and Level B takes [a] requested for rare species for all activities conducted for the effective period of the LOA (5-year total).

Species		Stock Size	2025[b]			2026			2027			2028			2029		
			Level A	Level B	Max %	Level A	Level B	Max %	Level A	Level B	Max %	Level A	Level B	Max %	Level A	Level B	Max %
LF	Blue whale[c]	402	0	0	0.00	1	2	0.75	1	2	0.75	1	2	0.75	0	0	0.00
MF	Clymene dolphin	4,237	0	0	0.00	0	167	3.94	0	167	3.94	0	167	3.94	0	0	0.00
	False killer whale[d]	1,791	0	5	0.28	0	10	0.56	0	10	0.56	0	10	0.56	0	5	0.28
	Fraser's dolphin	NA	0	0	NA	0	192	NA	0	192	NA	0	192	NA	0	0	NA
	Killer whale[d]	NA	0	2	NA	0	4	NA	0	4	NA	0	4	NA	0	2	NA
	Melon-headed whale	NA	0	0	NA	0	109	NA	0	109	NA	0	109	NA	0	0	NA
	Pantropical spotted dolphin	6,593	0	0	0.00	0	60	0.91	0	60	0.91	0	60	0.91	0	0	0.00
	Pygmy killer whale	NA	0	0	NA	0	5	NA	0	5	NA	0	5	NA	0	0	NA
	Rough-toothed dolphin	136	0	0	0.00	0	14	10.29	0	14	10.29	0	14	10.29	0	0	0.00
	Spinner dolphin	4,102	0	0	0.00	0	51	1.24	0	51	1.24	0	51	1.24	0	0	0.00
	Striped dolphin	67,036	0	0	0.00	0	64	0.10	0	64	0.10	0	64	0.10	0	0	0.00
	White-beaked dolphin[d]	536,016	0	30	0.01	0	60	0.01	0	60	0.01	0	60	0.01	0	30	0.01
	Beluga whale	131,450	0	0	0.00	0	2	0.00	0	2	0.00	0	2	0.00	0	0	0.00
	Cuvier's beaked whale	5,744	0	0	0.00	0	3	0.05	0	3	0.05	0	3	0.05	0	0	0.00
	Blainville's beaked whale	10,107	0	0	0.00	0	4	0.04	0	4	0.04	0	4	0.04	0	0	0.00
	Gervais' beaked whale	10,107	0	0	0.00	0	4	0.04	0	4	0.04	0	4	0.04	0	0	0.00
	Sowerby's beaked whale	10,107	0	0	0.00	0	4	0.04	0	4	0.04	0	4	0.04	0	0	0.00
	True's beaked whale	10,107	0	0	0.00	0	3	0.03	0	3	0.03	0	3	0.03	0	0	0.00
	Northern bottlenose whale	NA	0	0	NA	0	4	NA	0	4	NA	0	4	NA	0	0	NA
HF	Dwarf sperm whale	7,750	0	0	0.00	2	2	0.05	2	2	0.05	2	2	0.05	0	0	0.00
	Pygmy sperm whale	7,750	0	0	0.00	2	2	0.05	2	2	0.05	2	2	0.05	0	0	0.00
PPW	Hooded seal	NA	0	0	NA	0	1	NA	0	1	NA	0	1	NA	0	0	NA

[a] Take is the yearly request for impact pile driving and HRG surveys calculated as described in Section 6.6.2 based on group size.
[b] For the purpose of this LOA request, Year 1 is assumed to be 2025 and foundation installation starts in 2026. These dates reflect the currently projected construction start year and are subject to change because exact project start dates and construction schedules are not currently available.
[c] Listed as Endangered under the ESA.
[d] Take for these species is based on PSO sighting group sizes; for all other species group size is from OBIS data.

and shown as a percent of population size (based on NOAA Fisheries SARs) in Table 78. To allow for maximum flexibility and uncertainty in construction schedules, when requesting takes for rare species a 3-year construction schedule was assumed, and it was assumed that one group of each of these species could be taken in any of the 3 years. To arrive at the total take request, it was assumed that take could occur in alternate years, so the total take request is based on 2 years of take (i.e., group size x 2). This provides a reasonable estimate of total takes, as a conservative measure, while accounting for the potential that a take could occur in any given calendar year.

The requested take of rare marine mammal species as a percentage of abundance used stock abundance available from NOAA Fisheries SARs (NOAA Fisheries 2021). However, these species are rarely seen in the WEA and thus the given population sizes may not be reflective of the size of the actual populations to which they belong. Where no abundance estimate is available for rare species from the SARs, the percentage of the population affected was not evaluated. However, because the preferred range of these rare species is outside the affected area, the number of takes in comparison to their total populations is likely to be quite small for all these species.

Table 77. Yearly number of Level A and Level B takes [a] requested for rare species for all activities conducted for the effective period of the LOA (5-year total).

Species		Stock Size	2025[b]			2026			2027			2028			2029		
			Level A	Level B	Max %	Level A	Level B	Max %	Level A	Level B	Max %	Level A	Level B	Max %	Level A	Level B	Max %
LF	Blue whale[c]	402	0	0	0.00	1	2	0.75	1	2	0.75	1	2	0.75	0	0	0.00
MF	Clymene dolphin	4,237	0	0	0.00	0	167	3.94	0	167	3.94	0	167	3.94	0	0	0.00
	False killer whale[d]	1,791	0	5	0.28	0	10	0.56	0	10	0.56	0	10	0.56	0	5	0.28
	Fraser's dolphin	NA	0	0	NA	0	192	NA	0	192	NA	0	192	NA	0	0	NA
	Killer whale[d]	NA	0	2	NA	0	4	NA	0	4	NA	0	4	NA	0	2	NA
	Melon-headed whale	NA	0	0	NA	0	109	NA	0	109	NA	0	109	NA	0	0	NA
	Pantropical spotted dolphin	6,593	0	0	0.00	0	60	0.91	0	60	0.91	0	60	0.91	0	0	0.00
	Pygmy killer whale	NA	0	0	NA	0	5	NA	0	5	NA	0	5	NA	0	0	NA
	Rough-toothed dolphin	136	0	0	0.00	0	14	10.29	0	14	10.29	0	14	10.29	0	0	0.00
	Spinner dolphin	4,102	0	0	0.00	0	51	1.24	0	51	1.24	0	51	1.24	0	0	0.00
	Striped dolphin	67,036	0	0	0.00	0	64	0.10	0	64	0.10	0	64	0.10	0	0	0.00
	White-beaked dolphin[d]	536,016	0	30	0.01	0	60	0.01	0	60	0.01	0	60	0.01	0	30	0.01
	Beluga whale	131,450	0	0	0.00	0	2	0.00	0	2	0.00	0	2	0.00	0	0	0.00
	Cuvier's beaked whale	5,744	0	0	0.00	0	3	0.05	0	3	0.05	0	3	0.05	0	0	0.00
	Blainville's beaked whale	10,107	0	0	0.00	0	4	0.04	0	4	0.04	0	4	0.04	0	0	0.00
	Gervais' beaked whale	10,107	0	0	0.00	0	4	0.04	0	4	0.04	0	4	0.04	0	0	0.00
	Sowerby's beaked whale	10,107	0	0	0.00	0	4	0.04	0	4	0.04	0	4	0.04	0	0	0.00
	True's beaked whale	10,107	0	0	0.00	0	3	0.03	0	3	0.03	0	3	0.03	0	0	0.00
	Northern bottlenose whale	NA	0	0	NA	0	4	NA	0	4	NA	0	4	NA	0	0	NA
HF	Dwarf sperm whale	7,750	0	0	0.00	2	2	0.05	2	2	0.05	2	2	0.05	0	0	0.00
	Pygmy sperm whale	7,750	0	0	0.00	2	2	0.05	2	2	0.05	2	2	0.05	0	0	0.00
PPW	Hooded seal	NA	0	0	NA	0	1	NA	0	1	NA	0	1	NA	0	0	NA

[a] Take is the yearly request for impact pile driving and HRG surveys calculated as described in Section 6.6.2 based on group size.
[b] For the purpose of this LOA request, Year 1 is assumed to be 2025 and foundation installation starts in 2026. These dates reflect the currently projected construction start year and are subject to change because exact project start dates and construction schedules are not currently available.
[c] Listed as Endangered under the ESA.
[d] Take for these species is based on PSO sighting group sizes; for all other species group size is from OBIS data.

Table 78. Summary of total Level A and Level B takes [a] requested for rare species for all activities conducted during New England Wind construction.

Species		Stock size	5-Year total		
			Level A	Level B	Max %
LF	Blue whale [b]	402	2	4	1.49
MF	Clymene dolphin	4237	0	334	7.88
	False killer whale [c]	1791	0	25	1.40
	Fraser's dolphin	NA	0	384	NA
	Killer whale [c]	NA	0	10	NA
	Melon-headed whale	NA	0	218	NA
	Pantropical spotted dolphin	6593	0	120	1.82
	Pygmy killer whale	NA	0	10	NA
	Rough-toothed dolphin	136	0	28	20.59
	Spinner dolphin	4102	0	102	2.49
	Striped dolphin	67036	0	128	0.19
	White-beaked dolphin [c]	536016	0	150	0.03
	Beluga whale	131450	0	4	0.00
	Cuvier's beaked whale	5744	0	6	0.10
	Blainville's beaked whale	10107	0	8	0.08
	Gervais' beaked whale	10107	0	8	0.08
	Sowerby's beaked whale	10107	0	8	0.08
	True's beaked whale	10107	0	6	0.06
	Northern bottlenose whale	NA	0	8	NA
HF	Dwarf sperm whale	7750	4	4	0.10
	Pygmy sperm whale	7750	4	4	0.10
PPW	Hooded seal	NA	0	2	NA

[a] Take is the total request for impact pile driving and HRG surveys calculated as described in Section 6.6.2 of the July 2022 LOA Application based on group size.
[b] Listed as Endangered under the ESA.
[c] Take for these species is based on PSO sighting group sizes; for all other species group size is from OBIS data.

7. Clearance and Shutdown Zones

The Proponent is generally proposing to follow the monitoring and mitigation measures outlined in the Proposed Rule. The only proposed revisions are related to the clearance and shutdown zones, where adjustments are proposed to reflect the updated modeling conducted. Suggested clearance and shutdown zones during operations are shown in Tables 79 – 82.

Table 79. Monopile Installation Clearance and Shutdown Zones in Meters

Species	PSO clearance zone[1]	PSO shutdown zone	PAM clearance zone	PAM shutdown zone for MP at 6,000 kJ	PAM monitoring zone[3]	Vessel separation distance
Impact Pile Driving						
NARW	Any distance[1]	Any distance[1]	[4]5,800	[5]2,700	12,000	500
Other baleen whales and sperm whales	[5]2,700	[5]2,700	[5]2,700	[5]2,700	12,000	100
Small whales and dolphins[2]	50	50	50	50	10,000	50
Harbor porpoise[2]	250	250	250	250	10,000	50
Seals[2]	50	50	50	50	10,000	50
Vibratory Pile Driving and Drilling						
NARW	Any distance[1]	Any distance[1]	[6]12,000	[5]2,700	12,000	500
Other baleen whales and sperm whales	[5]2,700	[5]2,700	[5]2,700	[5]2,700	12,000	100
Small whales and dolphins[2]	50	50	50	50	10,000	50
Harbor porpoise	250	250	250	250	10,000	50
Seals	50	50	50	50	10,000	50

[1] The proposed minimum visibility for North Atlantic right whales is ‘‘any distance,’’ above the minimum required by NMFS.

[2] The maximum injury $ER_{95\%}$ for small whales and dolphins is 0 m, so a minimum clearance and shutdown zone of 50 m is proposed. The maximum injury $ER_{95\%}$ for harbor porpoise is 240 m, so a minimum clearance and shutdown zone of 250 m is proposed.

[3] The PAM Monitoring Zone represents the distance at which marine mammals must be able to be acoustically detected.

[4] The NARW PAM clearance zone is the maximum behavioral range $R_{95\%}$ during impact driving (5,716 m [13 m, 6000 kJ] rounded to 5,800 m). For piles installed between May 1–May 15 and November 1–December 31, the PAM clearance and shutdown zone is 10km.

[5] The PSO clearance and shutdown zones and PAM clearance zones are based on the maximum injury $ER_{95\%}$ for baleen whales and sperm whales, which is 2,690 m (rounded to 2,700 m) for fin whales (13 m,6000 kJ, two per day, vibratory + impact).

[6] During vibratory pile driving and drilling, the PAM clearance zone is equivalent to the PAM monitoring zone for NARW.

Table 80. Jacket Foundation Installation Clearance and Shutdown Zones in Meters

Species	PSO clearance zone[1]	PSO shutdown zone	PAM clearance zone	PAM shutdown zone	PAM monitoring zone[3]	Vessel separation distance
Impact Pile Driving						
NARW	Any distance[1]	Any distance[1]	[4]5,100	[5]4,100	12,000	500
Other baleen whales and sperm whales	[5]4,100	[5]4,100	[5]4,100	[5]4,100	12,000	100
Small whales and dolphins[2]	50	50	50	50	10,000	50
Harbor porpoise	250	250	250	250	10,000	50
Seals	800	800	800	800	10,000	50
Vibratory Pile Driving and Drilling						
NARW	Any distance	Any distance	[6]12,000	[5]4,100	12,000	500
Other baleen whales and sperm whales	[5]4,100	[5]4,100	[5]4,100	[5]4,100	12,000	100
Small whales and dolphins	50	50	50	50	10,000	50
Harbor porpoise	250	250	250	250	10,000	50
Seals	800	800	800	800	10,000	50

[1] The proposed minimum visibility for North Atlantic right whales is ‘‘any distance,’’ above the minimum required by NMFS.

[2] The maximum injury $ER_{95\%}$ for small whales and dolphins is 0 m, so a minimum clearance and shutdown zone of 50 m is proposed. The maximum injury $ER_{95\%}$ for harbor porpoise is 230 m, so a minimum clearance and shutdown zone of 250 m is proposed. The maximum injury $ER_{95\%}$ for seals is 790 m, so a minimum clearance and shutdown zone of 800 m is proposed.

[3] The PAM Monitoring Zone represents the distance at which marine mammals must be able to be acoustically detected.

[4] The NARW PAM clearance zone is the maximum behavioral range $R_{95\%}$ during impact driving (5,016 m [4 m jacket, 3500 kJ]) rounded to 5,100 m). For piles installed between May 1–May 15 and November 1–December 31, the PAM clearance and shutdown zone is 10km.

[5] The PSO clearance and shutdown zones and PAM clearance zones are based on the maximum injury $ER_{95\%}$ for baleen whales and sperm whales, which is 4,020 m (rounded to 4,100 m) for fin whales (4 pin piles per day, vibratory + impact).

[6] During vibratory pile driving and drilling, the PAM clearance zone is equivalent to the PAM monitoring zone for NARW.

Table 81. HRG Survey Clearance and Shutdown Zones in Meters

Species	Clearance zone	Shutdown zone	Vessel separation zone
North Atlantic Right Whale	500	500	500
All other ESA-listed marine mammals (e.g., fin, sei, sperm whale)	500	100	100
All other marine mammal species[1]	100	100	50

[1] With the exception of seals and delphinids from general Delphinus, Lagenorhynchus, Stenella, or Tursiops

Table 82. UXO/MEC Detonation Visual and PAM Clearance Zones in Meters

Species	Visual clearance zone[1]	PAM clearance zone	PAM monitoring zone
North Atlantic Right Whale	Any distance	Any distance	12,000
Low-Frequency Hearing Group	3,800	3,800	12,000
Mid-Frequency Hearing Group	1,000	1,000	2,600
High-Frequency Hearing Group (Harbor Porpoise)	6,200	6,200	14,100
Seals	1,600	1,600	7,100

[1] The minimum visibility zones (i.e., the area which must be visibly clear of marine mammals) for UXO/MEC detonation is set at no less than 5 km.

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Appendix A. Description of Fisheries Monitoring Program

MEMORANDUM

Date: December 4, 2023

To: Permits and Conservation Division, Office of Protected Resources, NOAA Fisheries

From: Park City Wind LLC

Subject: New England Wind LOA - Description of Fisheries Monitoring Program

In support of its Letter of Authorization (LOA) Application for the New England Wind offshore wind development, Park City Wind LLC is submitting the following description of its fisheries monitoring program.

1.0 Fisheries Monitoring

Fisheries monitoring surveys have been developed for New England Wind in accordance with the recommendations set forth in "Guidelines for Providing Information on Fisheries for Renewable Energy Development on the Atlantic Outer Continental Shelf" (BOEM 2019), which is designed to:

- Identify and confirm which dominant benthic, demersal, and pelagic species are using the project site, and when these species may be present where development is proposed;
- Establish a pre-construction baseline which may be used to assess whether detectable changes associated with proposed operations occurred in post-construction abundance and distribution of fisheries;
- Collect additional information aimed at reducing uncertainty associated with baseline estimates and/or to inform the interpretation of research results; and
- Develop an approach to quantify any substantial changes in the distribution and abundance of fisheries associated with proposed operations.

Additional documents considered include ROSA's Offshore Wind Project Monitoring Framework and Guidelines (ROSA 2021), March 2022 Draft NOAA Fisheries and BOEM Federal Survey Mitigation Implementation Strategy-Northeast U.S. Region (Hare et al. 2022) and Recommended Regional Scale Studies Related to Fisheries in the Massachusetts and Rhode Island-Massachusetts Offshore Wind Energy Areas (MADMF 2018). The Fisheries Monitoring Plan (FMP) is being developed through a collaborative process and the Proponent has met with numerous regulatory agencies and stakeholders during the development of the plan including NMFS, BOEM, Massachusetts Department of Environmental Protection, Massachusetts Office of Coastal Zone Management, and RI CRMC. The FMP follows a similar approach that was used for the Vineyard Wind 1 FMP in order to improve data applicability across the region. The Vineyard Wind 1 plan was developed through a series of workshops involving fishers,

scientists, and agencies and was reevaluated in 2021 by another stakeholder review. Fisheries monitoring surveys will be carried out by scientists from the University of Massachusetts Dartmouth School for Marine Science & Technology (SMAST), who have developed a number of fisheries monitoring survey protocols and have been conducting baseline fisheries monitoring surveys in the SWDA since 2019.[5] A summary of the fisheries monitoring surveys to be conducted are listed below in Table 1.

Table 1 Proposed Fisheries Monitoring Surveys to be conducted by New England Wind[1]

Activity	Description	Take Requested	Risk Assessment and Mitigation Measures
Demersal Otter Trawl	A seasonal trawl survey following the Northeast Area Monitoring and Assessment Program (NEAMAP) survey protocol to sample fish and invertebrates in the SWDA and control area. 200 tows per year conducted for 20 minutes at 3.0 knots.	None	Minimal risk. Marine mammal monitoring will be conducted prior to deployment, during survey, and retrieval of nets. Survey vessel will follow mitigation measures as discussed below.
Ventless Trap Survey	A ventless trap survey following a survey protocol used by MA DMF, RI DEM, and other states to sample lobster, black sea bass, and Jonah crab. Survey will be conducted twice per month from May to December in 30 stations across the SWDA and control areas (with 6 lobster traps and 1 fish pot at each station).	None	Minimal risk. Mitigation measures are discussed in section 1.2.2. Survey vessel will follow vessel mitigation measures as discussed below.
Lobster Tagging Study	A tagging study conducted twice per month from May to December in conjunction with the ventless trap survey to tag lobsters with a carapace size of 40 mm or greater.	None	Minimal risk. Survey vessel will follow vessel mitigation measures as discussed in section below.
Neuston (surface zooplankton) Net Sampling	A zooplankton sampling of 30 stations across the SWDA and control areas; each station will be sampled twice per month from May to December. This survey will consist of 10-minute tows at 4.0 knots, in top 0.5 m of water column.	None	Minimal risk. Survey vessel will follow vessel mitigation measures as discussed below.
Drop Camera	An underwater camera survey to assess benthic fish and invertebrates. Conducted twice annually between April and September over 368 stations within the SWDA and control areas.	None	Minimal risk. Survey vessel will follow vessel mitigation measures as discussed below.

Notes:

1. The proposed fisheries monitoring surveys are subject to change based on agency and stakeholder feedback.

[5] A pilot video trawl survey in 2018 but the more comprehensive trawl and drop camera surveys started 2019.

1.1 General Mitigation Measures

Fisheries monitoring surveys for New England Wind will follow general vessel activity mitigation measures to protect marine mammals outlined below in addition to mitigation for the survey gear.

- Vessel operators and fisheries survey personnel working offshore will receive environmental training, including marine mammal species identification.

- Vessel operators and crew will maintain a vigilant watch for marine mammals and will adhere to legally mandated vessel speeds, approach limits, and other vessel strikes avoidance measures to reduce the risk of impact to NARWs and other marine mammals. Vessel distances from a marine mammal shall adhere to federal guidelines for species-specific separation distances. Vessels shall maintain a separation distance and exclusion zone that are applicable at the time of the surveys (currently 500 m for NARW, 200 m for other large whale species, and 50 m for dolphins, porpoises, and seals from the vessel and associated fishing gear).

- In the event a marine mammal is sighted when a vessel is in transit, the captain will remain parallel to the animal, slow down, or maneuver their vessel, as appropriate, to avoid a potential interaction with a marine mammal. Vessels will follow NMFS guidelines for vessel strike avoidance that are applicable at the time of the surveys by maintaining required separation distances from the animal, which will be monitored by trained vessel operators and crews.

- Vessel operators will check the NMFS' NARW reporting systems on a daily basis and travel at 10 kts or less in any Seasonal Management Area (SMA) or Slow Zone/Dynamic Management Area (DMA).

- Additionally, it is expected that vessel captains will monitor USCG VHF Channel 16 throughout the day to receive notifications of any sightings. This information would be used to alert the team to the presence of a NARW in the area and to implement mitigation measures as appropriate. Whenever multiple New England Wind vessels are operating, all sightings of listed species will be communicated between vessels.

- Vessel operators and crew will monitor for marine mammals prior to deployment of fishing gear (e.g., trawl net) and will continue to monitor until the gear is brought back on deck. If a marine mammal is sighted within 1 NM of the survey vessel within 15 minutes prior to the deployment of the research gear and it is considered to be at risk of interaction with the gear, the sampling station will be suspended until there are no sightings of marine mammals for at least 15 minutes within 1 NM of the sampling station. The vessel operator may also relocate the vessel away from the marine mammal to a different sampling location.

- Unless human safety would be compromised, there will be reasonable efforts made to recover lost gear within 24 hours. If the gear cannot be retrieved in 24 hours, the gear will be retrieved as soon as it is safe. All lost gear will be reported to the Department of Interior (DOI) in compliance with BOEM and BSEE's incident reporting requirements and procedures.

- In addition to lost gear, all lost or discarded marine trash and debris will be reported to DOI in compliance with BOEM and BSEE's requirements and reporting procedures. BOEM will share this information with NMFS.

1.2 Gear-Specific Mitigation

In conjunction with the general mitigation measures applicable to all fisheries survey vessels, gear-specific measures will also be implemented to avoid interactions with marine mammal species.

1.2.1 Demersal Otter Trawl Survey

The following mitigation measures will be utilized to minimize the potential for marine mammal capture during research trawling:

- At least one of the survey staff onboard will have completed training (within past 5 years) in protected species identification and safe handling.

- Trawl tows will be limited to a 20-minute trawl time at 3.0 knots.

- If a marine mammal is observed within 1 NM of the planned sampling station in the 15 minutes prior to gear deployment, the Proponent will delay setting the trawl until the marine mammal has not been observed for 15 minutes. The Proponent may also relocate the vessel away from the marine mammal to a different sampling location. If marine mammals are still visible from the vessel after relocation, the Proponent may decide to relocate again or move on to the next sampling station.

- If marine mammals are sighted before the gear is fully removed from the water, the vessel will slow its speed and maneuver the vessel away from the animals to minimize potential interactions with the observed animal.

- The vessel crew will open the codend of the trawl net close to the deck in order to avoid injury to animals that may be caught in the gear.

- Gear will be emptied immediately after retrieval within the vicinity of the deck.

- Trawl nets will be fully cleared and repaired if damaged before redeployment.

- If any protected species (including birds) are captured, they should be immediately released, and the incident should be reported in accordance with protected species

reporting requirements to NMFS and BOEM. All trawl survey activities will comply with relevant Take Reduction Plan regulations.

New England Wind does not anticipate and is not requesting the take of any marine mammal species incidental to fisheries research surveys. In the case of a marine mammal interaction, the Marine Mammal Stranding Network will be contacted immediately.

1.2.2 Ventless Trap Survey

The following mitigation measures will be utilized to minimize the potential for marine mammal entanglement in the vertical lines:

- Downlines of each string will utilize weak link technology to deter whale entanglements.
- Adequate gear for disentanglement (i.e., knife and boathook) should be onboard.
- To avoid entanglement with vertical lines, buoy lines will be weighted and will not float at the surface of the water and all groundlines will consist of sinking line.
- Buoy lines and linkages will be compliant with best practices. “Ropeless” gear may be tested and used. All buoys will be properly labeled with the scientific permit number and identification as research gear.
- In the event that any marine mammal or sea turtle is entangled in survey gear, the NMFS stranding hotline should be contacted immediately.
- All labels and markings on the buoys and buoy lines will be compliant with the applicable regulations, and all buoy markings will comply with instructions received by the NOAA Greater Atlantic Regional Fisheries Office Protected Resources Division.
- Survey gear will be removed outside of the sampling season (i.e., no wet storage).
- Gear will be compliant with the Atlantic Large Whale Take Reduction Plan.

New England Wind does not anticipate and is not requesting the take of any marine mammal species incidental to fisheries research surveys. In the case of a marine mammal interaction, the Marine Mammal Stranding Network will be contacted immediately.

2.0 References

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