Revolution Wind Farm and Revolution Export Cable – Offshore Wind Energy Project

Biological Assessment—Addendum

March 23, 2023

For the National Marine Fisheries Service

U.S. Department of the Interior
Bureau of Ocean Energy Management
Office of Renewable Energy Programs

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Acronyms and Abbreviations

APE	Area of Potential Effect
ASV	Autonomous surface vessel
BA	Biological Assessment
BOEM	Bureau of Ocean Energy Management
BSEE	Bureau of Safety and Environmental Enforcement
BRK	Port of Brooklyn, NY
COLREGS	International Regulations for Preventing Collisions at Sea, 1972
COP	Construction and Operations Plan
CTV	Crew transport vessel
DMA	Dynamic Management Area
DPS	Distinct population segment
DVS	Port of Davisville, RI
EEZ	Exclusive Economic Zone
EFH	Essential Fish Habitat
EO/IR	Electro Optical/Infrared
EPM	Environmental protection measure
ESA	Endangered Species Act
ft	feet
FRMP	Fisheries Research and Monitoring Plan
HDD	horizontal directional drill
HMS	Highly migratory species
IAC	Inter-Array Cable
ITR	Incidental Take Regulation request (Marine Mammal Protection Act)
JFF	Port of Jefferson, NY
km	kilometer
Lat	latitude
Long	longitude
m	meters
MEC/UXO	Munitions, Explosives of Concern/Unexploded Ordnance
MMPA	Marine Mammal Protection Act
MON	Port of Montauk, NY
NARW	North Atlantic right whale
NAS	Noise attenuation system
NBD	Port of New Bedford, MA
NFK	Port of Norfolk, VA
NLD	Port of New London, CT
NMFS	National Marine Fisheries Service
O&M	Operations and Maintenance
OCS	Outer Continental Shelf
OSS	offshore substation
OSS-link	offshore substation link cable
PAM	Passive Acoustic Monitoring
PLB	Paulsboro Marine Terminal, NJ
PRV	Port of Providence, RI
PSMMP	Protected Species Monitoring and Mitigation Plan
PSO	Protected species observer
Q1, Q2, Q3, Q4	Annual quarter (Jan-Mar, Apr-June, Jul-Sep, Oct-Dec)
QNC	Cashman Shipyard, Quincy, MA
QST	Quonset Point, RI
Revolution Wind	Revolution Wind, LLC
RI	Rhode Island
RIDEM	Rhode Island Department of Environmental Management
RI/MA WEA	Rhode Island/Massachusetts Wind Energy Area
ROV	remotely operated vehicle
RWEC	Revolution Wind Export Cable
RWF	Revolution Wind Farm
SAV	submerged aquatic vegetation

SMA	Seasonal Management Area
SPP	Port of Sparrow's Point, MD
TBD	to be determined
TSS	total suspended sediment
UXO	unexploded ordnance
WTG	wind turbine generators

1.0 Introduction

BOEM has prepared this addendum to the *Revolution Wind Farm and Revolution Wind Export Cable – Development and Operation: Biological Assessment*, dated January 30, 2023 (the Biological Assessment or BA), in response to a list of requests for clarification and additional information received by letter from the National Marine Fisheries Service (NMFS) on February 16, 2023. BOEM has organized the information requests in this letter into a comment and response matrix, which is provided in the following section. All information requests are addressed in this matrix and, where indicated, in revised figures included as attachments to this addendum.

Certain requests in the February 16, 2023, letter ask for additional information and analysis of potential impacts to benthic habitat and habitats used by prey species. The *Revolution Wind Farm and Revolution Wind Export Cable – Development and Operation: Essential Fish Habitat Assessment* (BOEM 2023a), referred to hereafter as the EFH Assessment, provides a detailed characterization of baseline conditions and potential effects on these resources. The EFH Assessment was submitted to NMFS on February 3, 2023. BOEM submitted an addendum to the EFH Assessment (BOEM 2023b) to NMFS on March 21, 2023, addressing a request for additional information and clarification received from NMFS on February 17, 2023. These documents are incorporated by reference in response to specific comments addressed in this addendum.

2.0 Project Schedule Revisions

Revolution Wind has developed a revised project schedule[1], which BOEM is providing this revised schedule to clarify our responses to NMFS's information request as Figure 1. The timing of construction activities that are likely to or could affect ESA-listed species are as follows:

- Landfall construction: Includes sea-to-shore transition construction. In-water work will begin in Q3 2023 and will be completed by February 1, 2024, to comply with February 1 to August 30 restrictions on dredging and seabed clearance activities North of the COLREGS line for state important species (defined in RI CRMC Category B Assent Final Decision, issued on February 8, 2023).

- RWEC installation: Begins mid Q3 2024, completed in late Q4 2025. Construction schedule in state waters subject to the above timing restrictions.

1 The lessee has submitted an updated Construction and Operations Plan (COP) to BOEM for review. This March 2023 version of the COP contains updates based on requests for information received from BOEM during preparation of NEPA and consultation documents. This addendum includes any new information available from the lessee as of March 2023, including any information presented in the March 2023 version of the COP. As soon as the COP has been completely reviewed, it will be replace the current version on BOEM's website: https://www.boem.gov/renewable-energy/state-activities/revolution-wind-farm-construction-and-operations-plan.

- IAC installation: Route clearance and seabed preparation for cable installation will begin in Q1 2024 and will be completed by mid-Q2 2024. Cable installation will begin in mid-Q3 2024 and will be completed by the end of that year.
- WTG installation: Will commence in Q2 2024 and will be completed by mid-Q4 2024.
- OSS installation: Route clearance and seabed preparation will begin in late Q2 2024 and will be completed by early Q3 2024. Foundation and OSS installation will occur in Q3 to Q4 2024. OSS-link installation will occur in Q1 2025.

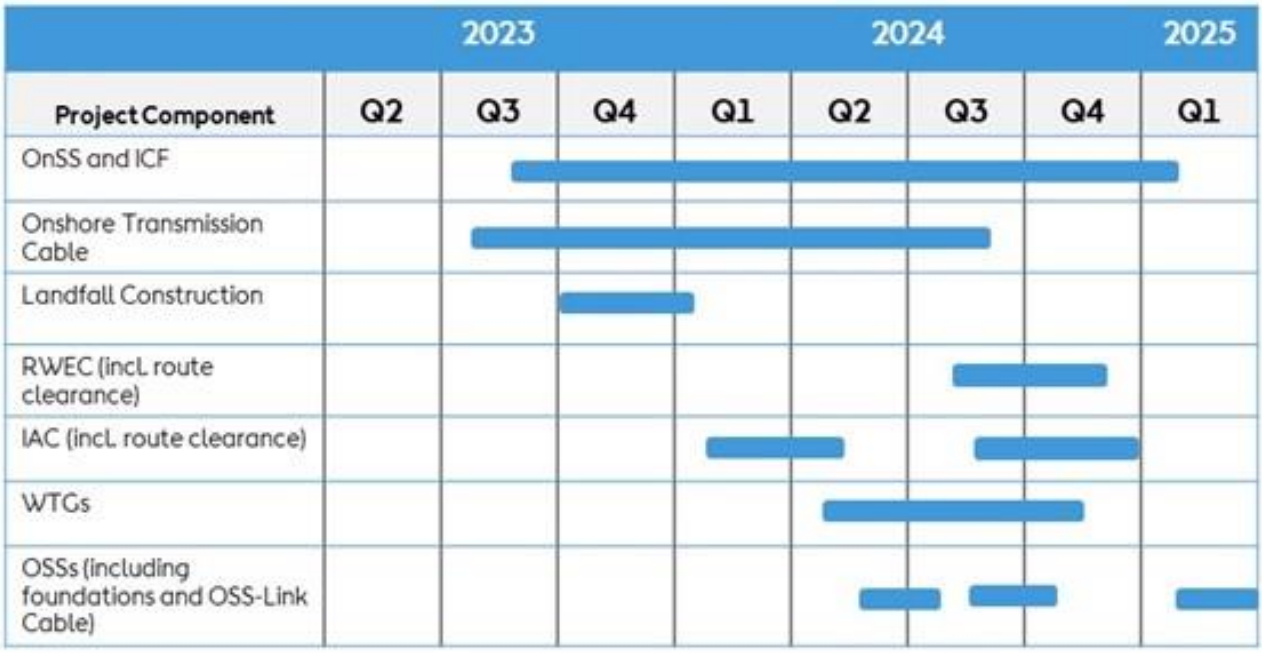

Figure 1. Indicative construction schedule for the Revolution Wind Farm and Revolution Wind Export Cable.

3.0 USACE Role

NMFS requested clarification of the United States Army Corps of Engineers's (USACE) role in enforcement. The language on page 3 of the January 2023 version of the BA should be replaced with the following language provided by the USACE:

> Under Section 404 of the Clean Water Act (33 U.S.C. 1344), USACE regulates the discharge of dredged or fill material into the waters of the United States (WOTUS). The USACE's 404 jurisdiction in tidal waters extends from the high tide line to the limits of the territorial seas (see 33 CFR § 328.4). The limit of jurisdiction in the territorial seas is measured from the baseline in a seaward direction a distance of three nautical miles. For the purposes of the proposed project, the shoreward limit of WOTUS would be the high tide line of Narragansett

Bay in North Kingstown, RI where the cables within the RWEC would make landfall. Proposed work subject to authorization under Section 404 would include the discharge of dredged or fill material related to cable installation and the placement of hard armoring for cable protection within the portions of the RWEC inside the limits of the USACE's Section 404 jurisdiction.

Under Section 10 of the Rivers and Harbors Act of 1899 (33 U.S.C.§ 403), the USACE regulates construction of any structures and work that are located in or that affect "navigable waters of the U.S." In tidal waters, the shoreward limit of navigable waters extends to the mean high water line while the seaward limit coincides with the limit of the territorial seas. The USACE's authority to prevent obstructions to navigation in navigable waters of the United States was extended to artificial islands, installations, and other devices located on the seabed, to the seaward limit of the outer continental shelf, by section 4(f) of the Outer Continental Shelf Lands Act of 1953 as amended (43 U.S.C. 1333(e) and 33 CFR 320.2). Structures subject to Section 10 jurisdiction on the RWF include the WTGs, scour protection around the base of the WTGs, two OSSs, IACs connecting the WTGs to the OSSs, and the OSS-link cables connecting the OSSs. Structures and work subject to Section 10 jurisdiction within the RWEC include the proposed export cables, dredging and seabed preparation associated with cable installation, hard armoring for cable protection, and dredging associated with the HDD pits. Revolution Wind submitted an individual permit application to USACE for the proposed work on June 3, 2022, and it was deemed complete on August 18, 2022 (USACE file number NAE-2020-00707).

USACE would be responsible for enforcement and compliance on all permit conditions in the USACE authorization. This would include EPMs and Mitigation and Monitoring Measures proposed in this BA that would be included in BOEM's FEIS and would be adopted in the joint ROD. In Table C-2 of Attachment C of this Addendum, BOEM has identified the anticipated enforcement agencies for each of these measures. USACE would also incorporate any biological opinions (BOs) associated with the project into its final permit decision and would include the following permit condition regarding the BO: "This Corps permit does not authorize you to take an endangered species. The enclosed NMFS BO contains mandatory terms and conditions to implement the reasonable and prudent measures that are associated with "incidental take" that is also specified in the BO. Your authorization under this Corps permit is conditional upon your compliance with all of the mandatory terms and conditions associated with incidental take of the attached BO, and any future BO that replaces it, which terms and conditions are incorporated by reference in this permit. Failure to comply with the terms and conditions associated with incidental take of the operative BO, where a take of the listed species occurs, would constitute an unauthorized take, and it would also constitute non-compliance with your Corps permit. NMFS is the appropriate authority to determine compliance with the terms and conditions of its BO, and with the ESA.

4.0 Responses to Information Requests

The comment and response matrix providing the additional information and clarification requested by NMFS is presented below as Table 1.

Table 1. BOEM responses to NMFS comments and requests for additional information received February 16, 2023 on the Revolution Wind Biological Assessment.

Comment/ Request #	BA Page #	Comment	Response
1	general	Nighttime pile driving/activities are not clearly or consistently addressed through the BA. The Description of the Proposed Action section, Mitigation/Monitoring Measures and the Effects of the Proposed Action inconsistently describe if/how nighttime activities will occur. We consider these high-risk activities that will require thorough and detailed assessment in the BA. Additionally, the Description of the Proposed Action section states that project activities will occur 24 hours per day, however, consideration of any project activities during nighttime hours is not considered in the Effects of the Proposed Action. It is also unclear what mitigation and monitoring measures will be implemented during nighttime hours and for which activities. The Proposed Mitigation, Monitoring, and Reporting Measures section and Effects of the Proposed Action section should address any applicable measures and the effects of these activities, respectively. More information needs to be provided in the BA to clarify under what conditions BOEM would consider allowing nighttime pile driving and how carrying out monitoring at night may or may not reduce the effectiveness of the proposed mitigation measures. In particular, in any instance where measures are relied on to avoid or reduce an effect (e.g., exposure of sea turtles to single strike noise levels that could cause injury and exposure to North Atlantic right whales to noise above the level A harassment threshold), a thorough explanation of how these same conclusions can be reached if pile driving occurs in the dark must be provided.	Revolution Wind is not proposing to conduct continuous impact pile driving 24-hours per day. Revolution Wind anticipates that installation of each monopile foundation would require up to 4 hours of impact pile driving, which equates to a maximum of 12 discontinuous hours of pile driving in any given 24-hour period at the stated maximum installation rate of three WTG or two OSS monopiles per day. Applying the strikes per pile assumptions presented in the BA, this equates to approximately 32,220 strikes for WTG installation and 23,126 strikes for OSS installation occurring over a maximum of 12 hours in any given 24-hour period. Foundation installation could theoretically be completed in less than 30 days at maximum installation rates. However, the project schedule allocates 5 months to provide the flexibility needed to accommodate vessel availability, weather delays, environmental protection measure implementation, compliance with mitigation measures, and other factors. As such, during any given week pile driving may or may not occur on a daily basis. The noise exposure analysis and individual animal exposure estimates presented in the BA are consistent with the information presented in the MMPA ITR application (LGL 2022). The exposure estimates and incidental take request presented in the ITR consider the effectiveness of planned mitigation measures, including the methods proposed for nighttime monitoring. In response to prior requests from NMFS and BOEM, Revolution Wind has submitted a report titled “Assessing Advanced Technology to Support an Option for Nighttime Monopile Installation” (ThayerMahan 2023). This report assesses the suitability and effectiveness of advanced technologies for detect marine mammals (particularly whales) at nighttime based on 1) a comprehensive review of current literature on the effectiveness of Electro Optical/Infrared (EO/IR) camera systems and Passive Acoustic Monitoring (PAM) systems during night operations, 2) controlled shore-based field testing of EO/IR camera systems under daylight and nighttime conditions using a whale blow

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			simulator, and 3) at-sea opportunistic field testing of electro-optical/infrared camera systems and PAM systems to assess monitoring effectiveness during low visibility and nighttime conditions. Though nighttime conditions appear to currently be the main focus. These experiments were designed to demonstrate the ability to maintain high standards for marine species protection during nighttime operations using newly available technologies. The report is currently under review by NMFS and BOEM staff, and Orsted is developing Alternative Monitoring Plans that include the use of the monitoring technologies for projects currently under review (Revolution Wind, Sunrise Wind, and Ocean Wind) and will be submitted to both agencies. Revolution Wind presented a summary of the methods and findings of this report to BOEM and NMFS staff in an online meeting on March 16, 2023.
2	general	It is not clear what conclusion you are reaching about shortnose sturgeon. Please clarify if you are making a “not likely to adversely affect” determination or a “no effect” determination for shortnose sturgeon.	BOEM has reached a “no effect” determination for shortnose sturgeon.
3	general	The discussion about the overlap between vessel traffic and critical habitat designated for Atlantic sturgeon is unclear. It appears that travel between the identified ports and the project area would not result in any transits in designated critical habitat; however, text on pg. 92 states that such travel is possible. This will need to be resolved.	Thank you for your comment. This discrepancy is attributable to conflicting project information received immediately prior to BA submittal. Based on updated information from the lessee, Revolution Wind is considering the Paulsboro Marine Terminal (Delaware River, New Jersey) for construction support. A revised summary of ports under consideration for construction and O&M support is provided as Attachment A to this addendum. With the exception of the Paulsboro Marine Terminal, all of the ports under consideration for construction and/or O&M support and associated vessel routes share no overlap with currently designated critical habitat for Atlantic sturgeon (82 FR 39160). The Paulsboro Marine terminal lies within designated Atlantic sturgeon critical habitat in the Delaware River. No port improvements or modifications to associated mooring areas or navigation channels are proposed, therefore there will be no project-related effects on the habitat access, habitat composition, and water quality components of critical habitat. Construction vessel traveling to and from this port would generate underwater noise in estuarine critical habitat. A review of representative

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			noise levels generated by project vessels is provided in BA Section 5.2.1. Project vessels could generate noise above behavioral effects thresholds for fish within a short distance (<450 feet) of the main navigation channel. This portion of the Delaware River migratory corridor is 3,000 feet or more wide, indicating that noise from individual project vessels would be unlikely to create an acoustic barrier that would impede the movement of adult sturgeon to and from spawning sites, physical feature (3)(i) of critical habitat. The Paulsboro Marine Terminal is located approximately downstream from several other major regional port facilities, including the Philadelphia Naval Yard and the Port of Philadelphia, the latter being one of the top 25 busiest ports in the nation in terms of cargo volume (USDOT 2023). Numerous large vessels accessing these and other nearby facilities transit the lower Delaware River on a daily basis. In this context, project-related vessel traffic is unlikely to measurably alter baseline underwater noise conditions in this component of Atlantic sturgeon critical habitat.
4	general	We note that the consideration of giant manta rays in this BA appears to be inconsistent with consideration of the species in other BAs in nearby lease areas. While we agree that Giant Manta Rays may be present along some vessel transit routes, based on Farmer et al. (2022), it appears to be extremely unlikely that any giant manta rays would be present in the lease area or along the cable corridors. We would be happy to discuss this with you further.	Noted, thank you for your comment. The analysis presented is consistent with the BA for the South Fork Wind project. BOEM will review and consider NMFS assessment of potential manta ray occurrence in the biological opinion.
5	general	As noted in the description of the action area, it must include all vessel transit routes. The BA is still unclear on the extent of the action area as it states vessel transits will occur from Europe or "elsewhere in the world." Clarifying the geographic region where vessel traffic will occur is needed in order to define the action area and subsequent listed species accurately.	Ports in the Gulf of Mexico, Europe, the east coast of Canada, or Asia could be used for construction support. No specific ports have been identified to date, as port selection will be determined by vessel availability, chartering terms, and other factors that will not be known until the project proceeds to the construction process. A description of potential vessel transit routes from distant ports, identification of ESA-listed species known or potentially occurring in these transit routes, and an assessment of the potential effects of vessel traffic on these species is provided in Attachment B to this addendum.

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6	general	The number of estimated UXOs/MECs in the BA is inconsistent with the proposed MMPA Incidental Take Regulations (ITR) (see 87 FR 79072, December 23, 2022). The BA states there are an estimated 16 UXOs/MECs but the proposed ITR addresses the planned detonation of 13. We would like to discuss this discrepancy and how best to move forward. Additionally, the mitigation/monitoring measures related to UXO/MEC detonation listed in Table 3.19 are very vague, please provide the specific language of the measures (e.g., rather than just stating “visual monitoring” identify the required sea turtle and marine mammal clearance zones, PSO requirements, etc.).	Regarding the 16 vs 13 UXOs, the lessee has stated that based on the available data collected to date, the Project will continue to request take for 13 detonations, as stated within the ITR application and MMPA Draft Rule. Revolution Wind has concluded that the 16 confirmed UXOs identified can be safely avoided by rerouting RWEC installation within BOEM's approved installation corridor. However, the UXO surveys conducted to date are not comprehensive. Revolution Wind believes that additional devices could be discovered during construction or pre-construction surveys, therefore the need for UXO detonation cannot be ruled out. Revolution Wind is requesting take coverage for up to 13 detonations to adequately address this risk. The project would attempt to mitigate emergent finds using other measures (e.g., lift and shift, cable rerouting) before resorting to detonation, but does maintain that 13 detonations are necessary for take coverage. Mitigation measures for UXO detonation are summarized in Attachment C.
7	general	Appendix B describes BOEM’s consideration of effects for vessel traffic in the Gulf of Mexico. However, it does not appear to consider effects of traffic along the U.S. South Atlantic coast to the project area. Additional analysis that includes consideration of this portion of the vessel traffic routes is necessary to support the conclusions made in the BA.	Appendix B in the BA considers vessel routes within the Gulf of Mexico (GOM) and between the GOM and the project area. However, it only introduces ESA-listed species that are not already considered in the BA. Please see Attachment B for a revised assessment of construction vessel traffic to distant ports. The effects of traffic along the U.S. South Atlantic coast was considered in the BA (e.g., sections 4.9 and 4.10).
8	general	Also, please note that there are a number of examples in the Effects of the Action section where impact conclusions are missing, unclear, or are described in a way that is inconsistent with ESA terminology. For example, on p. 147 the BA states, “Overall, the potential effect to Atlantic sturgeon from vibratory pile driving is considered insignificant but is still considered significant overall for underwater noise due to the effects of impact pile driving." While we interpret this to mean that you have determined that effects of vibratory pile driving are insignificant, you anticipate adverse effects to Atlantic sturgeon from other noise sources, we encourage you to describe conclusions more clearly in future BAs. Despite this confusing or missing text, we recognize that table 7.1 includes a complete description of BOEM’s	Noted. Thank you for your feedback.

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		conclusions regarding anticipated effects to listed species. We are interpreting “significant” in this table to mean “adverse” (i.e., not insignificant or discountable). In future BAs, please ensure that ESA terminology is used consistently throughout the BA.	
9	4	Clarify the role of USACE in enforcing compliance with project conditions (e.g., is this limited to conditions of any permits issued by the USACE) and ESA terms and conditions. Additionally, please clarify which agency is responsible for enforcing compliance with COP conditions and ESA terms and conditions in State waters.	The USACE has provided updated language to clarify their role in enforcement (see Section 3.0). Table C-2 in Attachment C lists anticipated enforcement agencies for mitigative measures, which includes the USACE when within their jurisdiction.
10	4	Confirm if Revolution Wind requested a PATON authorization in 2022.	No PATON was submitted on behalf of Revolution Wind in 2022. A PATON will be submitted prior to construction.
11	10	Confirm the proposed operational period (years) for the proposed project.	The BA states on subsequent pages (e.g., pages 35, 37, 43, and 166) that the operational life is approximately 35 years. For analysis purposes, BOEM assumes that the proposed Project would have an operating period of up to 35 years. Revolution Wind’s lease with BOEM (Lease OCS-A 0486) has an operations term of 25 years that commences on the date of COP approval (see 30 CFR 585.235(a)(3)). Revolution Wind would need to request and be granted an extension of its operations term from BOEM, 30 CFR 585.425-585.429, in order to operate the proposed Project for 35 years. While Revolution Wind has not made such a request, this BA uses the longer period in order to avoid possibly underestimating any potential effects.
12	20	Clarify if the installation schedule is still accurate with monopile, OSS, WTG, and cable installation occurring in 2023.	Per Section 3.2 of the Revolution Wind COP, construction is anticipated to begin in Q3 of 2023. Monopile, OSS, WTG, and cable installation (exclusive of the HDD landfall) will all occur in 2024.
13	25/26	The description of the “Vessel Traffic Component of the Action Area” is unclear relative to vessel traffic to foreign ports. Yet to be identified ports in the Gulf of Mexico and Europe are mentioned and create a reasonable action area, however, the inclusion of “elsewhere in the world” is problematic in defining the action area. The BA goes on to state that the effects analysis is restricted to transit routes in U.S. federal waters, however, that is inconsistent with the	Please see Attachment B for a revised assessment of construction vessel traffic to distant ports.

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		defined action area. If European or "other worldwide" ports are considered part of the proposed action, the effects of those activities need to be considered.	
14	26	Clarify that the proposed action includes 79 tapered 7/12-m monopiles to support WTGs and two tapered 7/15-m monopiles to support two OSSs. As written, the BA appears to only describe the maximum diameter of the piles.	Correct, the monopiles and OSS are tapered with a diameter range of 6-12 m for the WTG and 6-15 m for the OSS.
15	27	Clarify if the location identified in the "lift and shift" scenario for UXO/MEC disposal is within the lease area or elsewhere in the action area.	Lift and shift activities are anticipated to take place only where avoidance is not possible within both the lease and the export cable route, utilizing disposal areas within the APE. There are no specific disposal areas in the APE or the lease as a whole. Revolution Wind would examine the area near the UXO requiring lift and shift (lift and shift does not normally occur over large distances) and determine a designated area that does not pose a hazard to other infrastructure, marine archaeological feature, or other resources with a designated avoidance buffer.
16	27	Clarify if the 12 hours of pile driving is the maximum for a single monopile or the maximum for three monopiles installed in a 24-hour period.	Typical WTG monopile installation is anticipated to require 1 - 4 hours of impact pile driving per pile. Thus, 12 hours of impact pile driving is the maximum anticipated duration for installation of three monopiles in a 24-hour period.
17	28	As noted above, clarify if nighttime pile driving is considered part of the proposed action or if nighttime pile driving will only occur in instances where foundation installation takes longer than anticipated and delaying installation until daylight would present risks to safety and/or structural stability. There are a number of statements about nighttime pile driving throughout the BA that appear to be in conflict with each other. For example, footnote 2 on pg. 28 states that nighttime pile driving would only occur where foundation installation would take longer than anticipated while the text at the top of the page that implies that routine nighttime pile driving is planned.	Please see the response to comment #1. Revolution Wind is proposing conduct nighttime pile driving as needed to provide the schedule flexibility necessary to complete construction. Nighttime pile driving would only under during conditions where clearance zones can be effectively monitored to avoid and minimize adverse effects on ESA listed species. Orsted conducted an evaluation of available technologies and prepared a report of findings on their effectiveness and limitations (ThayerMahan 2023). NMFS has received this report and NMFS staff attended a virtual presentation summarizing these findings on March 16, 2023.
18	28	Clarify if concurrent pile driving is being proposed, such that one monopile and one OSS monopile (or two monopiles) would be installed at the same time. It is not clear if the text before table 3.5 is just stating that monopiles and OSSs	Revolution Wind is not proposing concurrent pile driving for RWF installation. No concurrent installation of WTG and/or OSS monopiles will occur and only one impact hammer will be operational at any given time. Sea-to-shore construction (including any associated pile driving) would

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		could be installed during the same 1-2 week period or that they could be installed simultaneously.	occur earlier on the project schedule. While separated in time, the sound field generated by this activity also shares no overlap with the future sound field generated by WTG and OSS foundation installation.
19	28	Clarify if the maximum impact scenario is three WTG monopiles per day AND two OSS monopiles per day or three WTG monopiles per day OR two OSS monopiles per day. Additionally, clarify if this scenario is still feasible if nighttime pile driving is not authorized and how the effects of pile driving would or would not change if nighttime pile driving does not occur.	BOEM confirms that a maximum of 3 WTGs OR 2 OSS could be installed per day (i.e., a maximum of three foundation piles per day). There is no separate schedule assuming no nighttime pile driving authorization. Should no nighttime pile driving be authorized, the assumption remains the same that up to three monopiles may be installed over a discontinuous 12-hour period during daylight hours.
20	30	A description of planned operation and maintenance activities for the OSS(s) is missing. Additionally, please clarify if the estimate of 52 CTV round trips annually is based on planned weekly maintenance activities or if this is a best estimate of frequency based on the “as needed” activities listed on Table 3.8 (noting that there are no activities identified in the table with a weekly frequency).	A description of planned operation and maintenance activities is provided in Table 3.9 of the BA. It represents the best available information on operations and maintenance and aligns with the information available in the COP. The 52 CTV round trips is the best available estimate of O&M frequency for this vessel class.
21	33	Unmitigated detonations are not mentioned in the effects analysis for UXOs and would be inconsistent with the activities described in the MMPA proposed ITR. As such, an explanation of why unmitigated detonations are mentioned is necessary. If unmitigated detonations are possible/planned, further discussion with us and our MMPA team is necessary.	No unmitigated detonations are proposed. As stated in the BA, Revolution Wind has identified 16 UXOs on the RWEC corridor to date. Subsequent to BA submittal, Revolution Wind determined that all 16 of these devices can be avoided without the need for detonation by rerouting RWEC installation. However, BOEM recognizes that additional devices could be discovered prior to or during construction and some of these devices may need to be detonated in place. Consistent with the ITR, BOEM is requesting incidental take coverage for detonation of up to 13 devices to account for this risk. For all UXO detonations, Revolution Wind will employ a noise attenuation system or systems capable of achieving a minimum 10-dB reduction in noise intensity. Technologies under consideration include big bubble curtain, Hydro-Sound Damper, and the AdBm Heimholz resonator.
22	35	Table 3.12 appears to be incomplete as the “Ports to be Used” column is filled out for only two of the rows and not all of the ports identified in Table 3.13 are included. While we understand that the exact number of trips to each port is not currently known, please provide the best reasonable	Please see Attachment A for currently available information on ports under consideration, the number of vessels and vessel trips by class, and representative vessel specifications.

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		estimate of the maximum estimated trips per potential port. Additionally, please add vessel length to Table 3.12.	
23	35-36	Clarify if Tables 3.11 and 3.12 incorporate the information in Appendix B or if that should be considered in addition to the information listed in the two tables. If the latter, vessel length, speed, and draft is needed for the vessel traffic described in Appendix B. Note that vessel types in Appendix B do not match all the vessel types in Table 3.12.	Please see Attachment A for currently available information on ports under consideration, the number of vessels and vessel trips by class, and representative vessel specifications.
24	35	Clarify if Table 3.12 includes potential vessel transits from Europe or "elsewhere in the world." Based on the text in the BA we understand that this would be no more than 10 trips between the project site and European ports. As indicated above, clarification is necessary regarding "elsewhere in the world."	Please see Attachment B for currently available information on distant ports, ESA-listed species occurrence in potential transit routes, and an assessment of potential impacts from vessel traffic.
25	37	Clarify the round trip distance for O&M trips from Davisville (note the sentence that states, "This would equate to an estimated 2,730 O&M vessel round trips over the 35-year life of the project, averaging approximately 82 miles round trip from the O&M port facility in Davisville, RI, and 96 miles round trip.) Additionally, clarify if all O&M vessel trips will originate from Davisville, RI; if not please include the additional ports that will be used.	Please assume all O&M vessel trips will originate from Davisville, RI (Quonset Point) at a round trip distance of 82 miles. Other facilities would only be used as backup ports.
26	35-37	Clarify if fisheries/benthic survey vessel usage is incorporated in Tables 3.12 and 3.14	Please see Attachment A for currently available information on ports under consideration, the number of vessels and vessel trips by class, and representative vessel specifications.
27	37	Please include the following information for all project vessels anticipated to be used in the O&M and Decommissioning phases: number and types of project vessels to be used, size (length, beam, draft, deadweight tons) speed, and operational speeds (maximum and average). This information is necessary to assess effects of vessel traffic on ESA-listed species. Additional information about necessary vessel/aircraft information and vessel strike analysis can be found in the ESA Information Needs	Please see Attachment A for currently available information on ports under consideration, the number of vessels and vessel trips by class, and representative vessel specifications.

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		document. Similar information should be provided for any aircraft and uncrewed systems usage.	
28	38	Please consider including in the BA the recent information shared by Orsted during the seafloor preparation presentations. These presentations provided greater specificity about the proposed activities; this additional detail would help to clarify the likely effects of these activities on listed species.	This information has been incorporated into the EFH Assessment for the project, and an addendum to that assessment addressing new and updated information. Those two documents are incorporated by reference. Seabed preparation impacts from foundation and cable installation are addressed in Sections 5.1.1.2 and 5.1.2.4 of the EFH Assessment, respectively. New information provided by Revolution Wind identifying the locations where specific cable installation methods will be used is summarized in Section 2 of the EFH addendum.
29	38	Clarify how large ripples and megaripples will be flattened and the approximate area impacted.	Revolution Wind has determined that leveling of ripples and megaripples will not be required for cable installation. Some flattening of these features may result from operation of the boulder plow and other cable trenching devices (e.g., the hydrojet and mechanical plows). The affected area is the estimated acres of benthic habitat impacts by habitat type from cable installation, which is incorporated by reference from the Essential Fish Habitat Assessment (see EFH Section 5.1.2.4, Tables 5.7 and 5.8). As documented, bedform features in soft-bottomed habitat are expected to recover in 18 to 24 months through natural sediment transport processes.
30	41	Please provide additional information (operational speed, water intake rate, intake opening size) on the water intake for the jet plow to inform our assessment of the risk of entrainment to prey species.	The March 2023 addendum to the EFH assessment summarizes currently available information on proposed cable installation technologies and where they will be employed. Only some of these technologies, i.e., the hydrojet and capjet, have hydraulic intakes. The mechanical plow, boulder plow, and mechanical cutter do not. Typical water intake rates for commercially available hydrojet technologies range from 800 to 3,000m^3 per hour based on reported specifications (e.g., https://www.prysmiangroup.com/en/markets/generation-transmission-and-distribution/installation-capabilities-and-submarine-solutions/installation-capabilities). Hydrojet intakes are screened to avoid and minimize entrainment of small fish but will entrain smaller organisms. Inspire Environmental (2018) evaluated potential hydrojet entrainment effects on planktonic organisms assuming an intake rate of 1,400 m^3/hour at a speed over ground of 1,600 to 3,200 meters per day, which is usefully

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			representative of the available range of technologies. This equates to an intake rate of approximately 33,600 m^3 per 24-hour workday. They determined that entrainment mortality from South Fork Wind project construction would impact less than 0.001 percent of the total zooplankton and ichthyoplankton abundance within a 25,270 hectare study area, as defined by a 15 to 25 km-wide buffer around the inter-array and export cable installation corridors. Inspire Environmental (2020) concluded that entrainment mortality rates from Revolution Wind construction would be similar to those from South Fork Wind construction, scaled to the proportion of overall cable length where this type of equipment is used.
31	41	Clarify what type of dredge will be used for cofferdam installation.	The seabed within the cofferdams would be dredged using a backhoe excavator deployed from a barge. The dredged material would be retained on a barge and used as backfill when construction is completed.
32	41	Additional information is needed about the sheet pile installation methods proposed for the sea-to-shore transition. Clarify if only sheet piles will be used, how many piles will be installed, duration of pile driving per day, and provide any other relevant project information. Additionally, clarify if goal posts will be installed to support the casing pipes. If so, additional project details are needed to describe those activities.	The HDD exit pit locations are in the nearshore zone in soft bottom habitat composed of mud and sandy mud. Proposed exit pit coordinates are as follows: HDD Exit Pit (East) Lat: N041° 34' 57.99" Long: W071° 25' 30.86" HDD Exit Pit (West) Lat: N041° 34' 56.75" Long: W071° 25' 32.10" No SAV or other sensitive habitat features are present in this area, as documented in the EFH Assessment and the Benthic Habitat Mapping Report (Inspire Environmental 2023, included as Appendix A to the EFH Assessment. Revolution Wind will avoid construction in state waters during the peak SAV growing season (i.e., July 1 to September 1), to minimize potential TSS and sediment deposition effects associated with sea-to-shore transition construction.

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			Revolution Wind is considering four potential HDD exit pit construction methods: • Casing pipe method: The HDDs would be directed into a casing pipe driven diagonally into the seabed. No dredging required for this construction method. The casing pipes would be installed using a pneumatic hammer deployed from a barge. Each pipe would be supported by up to six "goal posts," each comprising two vertical sheet piles driven into the substrate with a horizontal crossbeam. The goal post vertical sheet piles would be installed using vibratory hammer. Each vertical pile would be approximately 30 m (100 ft) long, by 0.6 m (2 ft) wide, by 2 cm (1 in) thick. Installation of the 44 goal post sheet piles would require approximately 6 days, assuming 7 piles installed per day, and 30 minutes of vibratory hammer operation per pile during the 7 a.m. to 6 p.m. construction period permitted by local noise ordinance (North Kingstown, RI Ord. No. 83-3(a)). Once sea-to-shore transition construction is complete the vertical goal post sheet piles would be removed using a vibratory hammer. The estimated duration of hammer operation for removal would be approximately the same as for installation. • Uncontained dredging: HDD exit pits will be dredged using a backhoe excavator and Venturi eductor device. No temporary construction structures would be used so no pile driving would be required. Once sea-to-shore transition construction is complete the HDD exit pits would be backfilled with the original dredged material. • Sheet pile cofferdam: The HDD exit pits will be contained within temporary sheetpile cofferdams. Once constructed, the seabed within the cofferdams will be dredged using a backhoe excavator deployed from a barge. Each cofferdam would measure 50 m (164 ft) long, by 10 m (33 ft) wide, and would extend 3 to 4 m (10 to 14 ft) above the water surface. Assuming standard sheet pile dimensions of 30 m (100 ft) long, by 0.6 m (2 ft) wide, by 2 cm (1 in) thick, this equates to approximately 197 sheet piles per cofferdam. Each cofferdam would require approximately 14 days to install at an installation rate of 14 sheet piles per day. Approximately 30 minutes of vibratory hammer operation would be required per pile, or 7 total hours during the 7 a.m. to 6 p.m. construction period permitted by local noise ordinance

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			(North Kingstown, RI Ord. No. 83-3(a)). Concurrent pile driving is not being proposed; therefore installation of both cofferdams would require 28 days. Once sea-to-shore transition construction is complete, the HDD exit pits would be backfilled with the original dredged materials and the cofferdam sheet piles would be removed using a vibratory hammer. The estimated duration of hammer operation for cofferdam removal would be approximately the same as for installation (i.e., 30 minutes/pile, 14 piles/day, 14 days/cofferdam, 28 days total). • Gravity cofferdam: HDD exit pits contained within pre-constructed cofferdams lowered onto the seabed from a barge and held in place by weight. No pile driving is required for installation or removal. Once constructed, the seabed within the cofferdams will be dredged using a backhoe excavator deployed from a barge. No temporary construction structures would be used so no pile driving would be required. Once sea-to-shore transition construction is complete, the HDD exit pits would be backfilled with the original dredged materials and the cofferdams would be lifted onto a barge for demobilization.
33	41	Clarify if 10 percent (similar to the RWEC) of the OSS link route will require additional cable protection measures.	Cable protection will be required on up to 10 percent of the OSS-link route. As stated, the precise locations where cable protection will be required are not currently known. Post-construction HRG surveys will be used to identify locations where cable burial to desired target depths of 4 to 6 feet has not been achieved. Revolution Wind will assess the need for cable protection at each location based on site-specific risk factors, including sediment mobility, and the likelihood of cable disturbance by vessel anchoring, fishing activity, and other activities. BOEM is providing a clarification regarding RWEC cable protection. Revolution Wind initially estimated that up to 10 percent of RWEC circuit length would require cable protection where post-construction surveys determine burial to desired target depths has not been achieved. Subsequent to submittal of the BA on January 30, 2023, Revolution Wind decreased this estimate to 5 percent of route length for each RWEC circuit. These specific locations where cable protection will be required are not currently known for the same reasons described above.

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			In addition to the above, cable protection will be required at seven known locations where the RWEC crosses buried utilities identified during pre-construction surveys. The indicative locations for the crossing points are displayed on the Revolution Wind pop-up viewer and are as follows: - U.S. Army/RI (abandoned water main): Lat 41.506918, Long -71.409197 - Verizon (telecommunications cable): Lat 41.492481, Long -71.408455 - Verizon (telecommunications cable): Lat 41.491883, Long -77.4084 - Verizon (telecommunications cable): Lat 41.488649, Long -71.408158 - Unknown (TBD): Lat 41.488341, Long -71.408144 - Unknown (TBD): Lat 41.487651, Long -71.408103 - Unknown (TBD): Lat 41.431417, Long -71.407095 Cable protection requirements at these locations comprise an additional 9.5 percent of RWEC route length. Therefore, the total amount of RWEC cable protection required at currently known and unknown locations will comprise approximately 14.5 percent of route length.
34	44	Clarify if HRG surveys will continue during the O&M phase or just prior to, during, and immediately after construction.	Revolution Wind will conduct HRG surveys before, during, and immediately after construction in years 1-5. The Year 1 survey effort is projected at 9,559 km over 137 days. Following construction (i.e., in Years 2–5), Revolution Wind anticipates to survey 2,117 km over 31 days per year.
35	44	NMFS 2021a did not assess the deployment of PAM buoys, it considered the deployment of meteorological buoys. Please provide additional information about the proposed PAM buoys, including number and mooring type.	Revolution Wind is proposing to deploy four PAM buoys for construction monitoring. The buoys would be placed approximately equidistant on a 5000m radius circle centered around each foundation site before pile driving begins. The buoys will be relocated to each new foundation site as construction proceeds. Revolution Wind will most likely deploy autonomous or moored-remote PAM devices, including sonobuoy arrays or similar retrievable buoy systems. Revolution Wind is not considering seafloor cabled anchoring systems. Attachment 4 of the Protected Species Mitigation and Monitoring Plan (included as Appendix C of the BA) provides a thorough description of the PAM systems under consideration.

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			BOEM notes that NMFS has applied NMFS (2021) PDC 6 terms and conditions to PAM buoy deployment in prior Section 7 consultations (see Section 7.5.1 of the Biological Opinion for the South Fork Offshore Energy Project, GARFO-2021-00353). BOEM assumes that similar terms and conditions will apply to the Revolution Wind project, with modifications as appropriate at NMFS discretion.
36	46	Clarify how many traps will be used for the BACI and BAG surveys. The BA states ten traps will be used for each survey, but later in the paragraph states that there will be four ventless traps and two vented traps, which would be only six traps per trawl.	BOEM confirms that each survey trawl will comprise six ventless traps, and four standard vented traps. BACI and BAG trap surveys in the lease area will both use 10-trap trawls spanning 900 feet of groundline, with traps separated from each other by approximately 100 feet. Details of this plan are provided in the BA as Appendix A – Fisheries Research and Monitoring Plan.
37	46	The Fisheries Research and Monitoring Plan mentions a State Waters Ventless Trap Survey but it is not mentioned in this section. Please clarify if this survey is part of the proposed action.	The state waters ventless trap survey is conducted by the Rhode Island Department of Environmental Management (RIDEM) as an extension of their existing and long running lobster survey program. BOEM has determined that this ongoing activity is the sole responsibility of RIDEM and would continue regardless of the approval decision for the proposed action; as such, BOEM has determined these surveys are not part of the proposed action and they not considered further in the BA. However, the data generated by RIDEM's survey program will inform the findings of the FRMP (see Appendix A of the FRMP, provided as Appendix A to the BA).
38	47	Confirm if the acoustic telemetry study across the Orsted/Eversource lease sites was already included in the South Fork BA and subsequent biological opinion as the BA states that Revolution Wind is providing additional funding/receivers to ongoing survey efforts. Additionally, clarify if capture of animals for the telemetry survey is part of the proposed action and if so, describe the survey methods, timing, duration, and target species.	The target species for the HMS acoustic telemetry study are blue fin tuna, blue sharks, and shortfin mako, although other HMS species (e.g., marlin) may be tagged opportunistically if captured during tagging trips. The methods are those referenced within Section 4.3.1 of the Revolution Wind Fisheries Research and Monitoring Plan (Appendix Y of the Revolution Wind COP). This study deployed 17 acoustic receivers in the Revolution Wind lease area in May 2022, and those receivers will remain at those locations through December 2026. Additionally, acoustic receivers were also deployed in South Fork Wind (n=2) and Sunrise Wind (n=13) lease areas in May 2022 as part of the HMS telemetry study. Due to Project constraints, a total of 32 receivers rather than the 36 referenced in the Plan are deployed. As stated in the Plan, ropeless technology (AR Buoys) was selected to minimize risks to marine mammals and other

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			protected species. In total, 150 transmitters were acquired and tagging efforts will occur in summer of 2023 and continue through 2025. All tagged animals will be collected using rod and reel, and procedures will follow the New England Aquarium Animal Care and Use Protocols. This Project will utilize the same tagging methodology and technology as the South Fork Wind Project and is intended to increase the detection and tracking capabilities of this regional acoustic telemetry network. The fundamental difference of the Revolution Wind study is centered around the objective analysis of these data to assess the spatial distribution and behavior of HMS tagged animals across a broader range than was initially focused on with South Fork.
39	51	Note that Table 3.17 still mentions 102 foundations.	BOEM apologies for this oversight and confirms that the proposed action includes the installation of up to 79 WTGs and 2 OSS.
40	54	Table 3.18 contains broad mitigation and monitoring measures proposed by Revolution Wind and refers to Appendix B - Protected Species Mitigation and Monitoring Plan (actually Appendix C) for more details. However, the PSMMP only contains additional details about measures for marine mammals. If Table 3.18 is only going to be a summary of proposed measures, the relevant details must be provided in an appendix. Alternatively, the complete text of the measures should be included in the table. For example, Table 3.18 states that “shutdown and clearance zones for marine mammals and sea turtles will be established…” but does not say how big those zones will be, duration of monitoring, number of PSOs, etc. Additionally, please ensure the table reflects the most up to date measures proposed in the proposed MMPA ITR (https://www.fisheries.noaa.gov/action/incidental-take-authorization-revolution-wind-llc-construction-revolution-wind-energy) or incorporate those by reference. Please also clarify what it means for Revolution Wind to be the “anticipated enforcing agency” this seems to be highly problematic for the developer to be in charge of enforcing measures.	Correct, the February 2022 PSMMP is provided as Appendix C to the Biological Assessment. We regret the editorial error. Current mitigation measures proposed for protection of ESA-listed species are provided as Attachment C to this addendum.

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41	57	Additional relevant details are needed for some mitigation and monitoring measures listed in Table 3.19 as they do not all contain complete information or are unclear. For example, measure #8 states marine mammal shutdown zones would be applied to sea turtles; however, that seems to be impractical given the likely detection distance for sea turtles. Please describe the planned shutdown and clearance zones and monitoring plans with specifics. As indicated above, please provide the specific language of the measures for UXO/MEC detonations (e.g, rather than just stating "visual monitoring" identify the required sea turtle and marine mammal clearance zones, PSO requirements, etc.). Additionally, clarify if BOEM is applying all the vessel strike avoidance measures in the proposed MMPA ITR to the O&M and decommissioning phases, the BA states they would be applied "as appropriate."	Current mitigation measures proposed for protection of ESA-listed species are provided as Attachment C to this addendum.
42	57	Confirm if there are any time of year restrictions for any dredging or clearance activities for large ripples and megaripples	Revolution Wind has determined that seabed leveling and dredging will not be required as part of seabed preparation for cable installation (dredging will be used for sea-to-shore transition construction as described above in the response to request #32). Some incidental leveling of ripples and megaripples would result from operation of the boulder plow and other cable trenching equipment. These effects would occur within benthic impact footprint for cable installation activities described in the BA and this addendum. The only time of year restriction identified to date applies to dredging and seabed clearance activities in RI state waters as follows: • Feb 1 to Aug 30: North of the COLREGS line for state important species. (Defined in RI CRMC Category B Assent Final Decision, issued on February 8, 2023).
43	57	Clarify if any mitigation/monitoring measures are proposed during the pile driving installation of the cofferdam/sheet piles/goal posts.	Current mitigation measures proposed for protection of ESA-listed species are provided as Attachment C to this addendum.
44	58	Please incorporate the plan (PAM Plan, Pile Driving Monitoring Plan, etc.) submittal timing from the Sunrise BA,	NMFS's request is noted. At this time, BOEM is not changing the submission deadline beyond 90 days for these plans. BOEM notes the

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		all of these plans should be submitted 180 days in advance rather than 90 days.	draft ITR for Revolution Wind cites 180 day submission deadlines. Assuming this does not change in the final ITR, the lessee would need to comply with the earlier deadline. The level of detail needed for a review is unlikely to be available 180 days out from the planned start of an activity. The language regarding timing of plan submission in the BA has not been revised.
45	133/146/147	The estimates of pile driving noise and distances to thresholds of concern associated with the sea-to-shore transition site were developed using a tool that has been replaced. Please provide us with estimates of noise from pile installation at the sea-to-shore installation using the NMFS Multi-Species Pile Driving Calculator. The calculator and a PowerPoint presentation providing an overview and instruction is available on NMFS website (https://www.fisheries.noaa.gov/national/marine-mammal-protection/marine-mammal-acoustic-technical-guidance, scroll to the bottom under "Other NMFS Acoustic Thresholds and Tools").	To clarify, BOEM did not use the GARFO noise impact assessment tool to generate the threshold distances presented in the BA. We reported modeled threshold distances developed by Revolution Wind/JASCO to support the COP and ITR. JASCO used the GRLWEAP/PDSM/FWRAM models, and the MONM model, respectively, to estimate threshold distances for pneumatic hammer (casing pipe installation) and vibratory hammer (sheet pile installation) operation. The BA reports the minimum and maximum modeled threshold distances for all species in each hearing group across all conditions and pile driving methods. The models used by JASCO provide a far more accurate representation of potential noise impacts than the generalized formulae used in the NMFS multi-species calculator. Therefore, we do not believe it is necessary revise the estimated distances to thresholds using the updated NMFS tool.
46	170	Section 5.5 of the BA is missing consideration of effects from habitat disturbance from UXO/MEC detonations and seafloor preparation activities (i.e. boulder plow, depressions, ripples and megaripple flattening). Consideration of the effects of entrainment risk to prey species due to the jetplow are also missing.	BOEM has incorporated the EFH Assessment by reference. Section 5.1.1.3 of the EFH Assessment presents an analysis of the effects to the seabed habitat from UXO/MEC denotations and seabed preparation activities. An analysis of entrainment risk to prey species is provided in Section 5.1.2.4.
47	176	Clarify which sea-to-shore construction method was considered for the turbidity analysis.	The TSS and sediment deposition impact analysis is based on modeled impacts of uncontained dredging of the two HDD exit pits using a backhoe excavator and venturi eductor device. This would be the most impactful of the four sea-to-shore transition construction methods under consideration. The analysis provided in the BA relies on the suspended sediment plume and deposition modeling results in the Hydrodynamic and Sediment Transport Modeling Report (RPS 2022), presented as COP Appendix J.
48	general	We have identified a number of additional mitigation measures that we encourage BOEM to consider incorporating into the proposed action. These include	Thank you for your comment. BOEM is not proposing any additional mitigation measures at this time.

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		incorporating measures to limit the potential for pile driving in December, requiring that ropeless/on-demand gear be used for ventless trap surveys, and incorporating measures to reduce the risk of vessel strike to Rice's whales during transits in the Gulf of Mexico (set of measures can be provided).	

5.0 References

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Attachment A – Revised Summary of Vessel Traffic and Vessel Specifications by Class, and Regional Ports Under Consideration for Construction Support

This attachment summarizes currently available information requested by NMFS related to construction vessel traffic for the Revolution Wind project. NMFS has requested detailed information about the classes of vessels proposed for project construction, and the number of vessels, planned number of trips between the Lease Area and regional ports, and specifications (i.e., length, beam, draft, tonnage, and typical operational speed) for each class. BOEM has obtained all currently available information from the lessee, supplemented with additional commercially available information for the various vessel classes operating in the offshore wind industry. This information is presented in Tables A-1 and A-2 below.

Table A-1 summarizes the following:

- Vessel classes proposed for RWF and RWEC construction.
- The number of vessels, estimated number of round trips between the Lease Area and regional ports, and associated construction element by vessel class
- Indicative vessel size and operational speed specifications by vessel class
- Currently identified ports under consideration for construction support by vessel class, which comprise:
    - New York: Port of Montauk (MON), Port Jefferson (JFF), Port of Brooklyn (BRK)
    - Rhode Island: Port of Providence (PRV), Port of Davisville, and Quonset Point (DVS, QST),
    - Connecticut: Port of New London (NLD),
    - Virginia: Port of Norfolk (NFK),
    - Massachusetts: New Bedford Marine Commerce Terminal (NBD), Cashman Shipyard (Quincy, MA; QNC),
    - Maryland: Sparrow's Point (SPP),
    - New Jersey: Paulsboro Marine Terminal (PLB)

The information in the first two bullets was obtained from the lessee in March 2023. No specific vessels have been selected for project construction at this time. BOEM is providing specifications for representative vessels in each vessel class obtained from several available

sources (Boskalis 2020, 2022; Buljan 2023; HGIM 2020; Marine Traffic 2023; Memija 2023; BOEM 2022; Ørsted 2023; Prysmian Group 2018; Seaway 2022; Skopljak 2022; Wärtsilä 2023).

Vessel types used for project O&M and the anticipated number of O&M trips per year are identified in Table 3.14 in the main body of the BA. As shown, routine maintenance activities would be conducted by crew transport and service operations vessels (CTVs and SOVs, respectively). Non-routine maintenance may be conducted by the same types of jack-up vessels, cable laying vessels, and large material and support barges used for project construction. Therefore, the representative vessel specifications provided in Table A-1 for each of these vessel classes can also be used to evaluate potential impacts from O&M vessel traffic.

Table A-2 identifies regional ports currently (as of March 2023) under consideration by Revolution Wind for project construction support. This list includes ports that were previously under consideration for construction support but are not currently identified in Table A-1. The number of vessels and distribution of vessel trips between ports is subject to change as project planning proceeds.

Table A-1. Vessel classes proposed for project construction, number of vessels and anticipated number of vessel trips required for project construction, and indicative specifications by vessel class.

Vessel Type	Number of Vessels	Vessel Trips	Anticipated Ports[‡]	Construction Element						Representative Specifications by Class				
				Foundations	OSS	RWEC	IAC	OSS-Link	WTGs	Length ft (m)	Beam ft (m)	Draft ft (m)	Operating Speed (knots)	Tonnage[†]
Anchor Handling Tug	2	50	QST	●	--	●	--	●	--	98 (30)	49 (15)	23 (7)	4	345 GT
Boulder Clearance Vessel	2	13	PRV, QST, DVS, NBD	●	●	●	●	●	--	312 (70)	66 (20)	23 (7)	23	3,285 LT
Bubble Curtain Vessel	1	20	PRV	●	--	--	--	--	--	295 (90)	66 (20)	23 (7)	23	4,900 T
Cable Burial Vessel	1	6	PRV, QST, DVS, NBD	--	--	--	●	●		328 (100)	98 (30)	16 (5)	2.4	12,200 Te
Cable Burial Vessel - Remedial	1	1	PRV, QST, DVS, NBD	--	--	●	--	--	--	328 (100)	98 (30)	16 (5)	2.4	12,200 Te
Cable Lay & Burial Vessel (Export)	1	5	PRV, QST, DVS, NBD	--	--	●	--	--	--	427 (130)	98 (30)	16 (5)	2.4	10,800 Te
Cable Lay Vessel (Barge)	1	3	PRV, QST, DVS, NBD, QNC	--	--	●	--	--	--	400 (122)	110 (33.5)	25 (7.6)	2.4	10,000 Te
Cable Laying Vessel	1	6	PRV, QST, DVS, NBD	--	--	--	●	●	--	459 (140)	95 (30)	16 (5)	2.4	10,000 Te
Crew Transfer Vessel (CTV)	6	870	JFF, PRV, QST, DVS, NBD, NLD	●	●	●	●	●	●	98 (30)	36 (11)	10 (3)	23	235 GT
DP2 Construction Vessel	2	7	PRV	--	--	●	●	●	--	758 (231)	160 (49)	33 (10)	11	60,825 GT
Fall Pipe Vessel	1	6	PRV	●	--	--	--	--	--	531 (162)	125 (38)	21 (6.4)	13	28,734 T

Vessel Type	Number of Vessels	Vessel Trips	Anticipated Ports‡	Construction Element						Representative Specifications by Class				
				Foundations	OSS	RWEC	IAC	OSS-Link	WTGs	Length ft (m)	Beam ft (m)	Draft ft (m)	Operating Speed (knots)	Tonnage†
Fuel Bunkering Vessel	1	8	To be determined	--	--	--	--	--	●	295 (90)	62 (19)	17 (5.2)	10	3,500 T
Guard Vessel/Scout Vessel	6	8	PRV, QST, DVS, NBD, New York or Asia	●	●	●	●	●	--	90 (27)	33 (10)	16 (5)	12	700 T
Heavy Lift Installation Vessel	1	1	NLD, QST	●	--	--	--	--	--	787 (240)	164 (50)	44 (13.5)	10	61,000 T
Heavy Lift Installation Vessel (Secondary Steel)	1	1	NLD, QST	●	--	--	--	--	--	787 (240)	164 (50)	44 (13.5)	10	61,000 T
Heavy Transport Vessel	5	26	NLD, QST, Canada or Asia	●	●	--	--	--	--	715 (218)	141 (43)	33 (10)	13.5	50,000 Te
Helicopter	1-2	76	DVS	●	●	--	--	--	●	n/a	n/a	n/a	n/a	n/a
Jack-Up Installation Vessel	1	20	NLD, QST	--	--	--	--	--	●	459 (140)	131 ft (40)	23 (7)	10	8,000 T
Lift Boat – Jack-Up Accommodation Vessel	1	1	JFF, QST	●	●	●	●	●	●	787 (240)	164 (50)	23 (7)	10	61,000 T
Platform Supply Vessel	3	85	PRV	●	--	--	--	--	--	300 (92)	69 (21)	21 (6.5)	11.5	6,200 T
Pre-lay Grapnel Run Vessel	2	6	PRV, QST, DVS, NBD, New York or Gulf of Mexico	--	--	●	●	●	--	262 (80)	66 (20)	23 (7)	23	2,400 GT

Vessel Type	Number of Vessels	Vessel Trips	Anticipated Ports‡	Construction Element						Representative Specifications by Class				
				Foundations	OSS	RWEC	IAC	OSS-Link	WTGs	Length ft (m)	Beam ft (m)	Draft ft (m)	Operating Speed (knots)	Tonnage†
PSO Noise Monitoring Vessel	4	80	PRV	●	--	--	--	--	--	295 (90)	66 (20)	23 (7)	23	4,900 T
Safety Vessel	2	100	JFF, QST	●	●	●	●	●	●	90 (27)	33 (10)	16 (5)	12	700 T
Service Operations Vessel (SOV)	2	7	JFF, QST	●	●	●	●	●	●	268 (82)	59 (18)	24 (7.5)	23	4,100 T
Supply Barge	1	4	PRV, QST, DVS, NBD, New York or Gulf of Mexico	●	--	●	●	●	--	300 ft (91)	44 (13.4)	17 (5)	4	5,480 T
Supply Vessel	1	30	PRV	●	●	●	●	●	●	348 (106)	72 (22)	31 (9.4)	12	6,000 GT
Survey Vessel	1	11	PRV, QST, DVS, NBD, New York or Gulf of Mexico	--	--	●	●	●	--	164 (50)	39 (12)	23 (7)	18	235 GT
Tow Tug	5	29	QST	●	--	--	--	--	●	148 (45)	49 (15)	23 (7)	4	450 GT

Symbols: ● = vessel used for this element, -- = vessel not used for this element.

‡ Potential ports in New York comprise the Ports of Montauk, Jefferson, and Brooklyn. Some vessels may deploy to the project area from currently unidentified ports in the Gulf of Mexico, Canada, and Asia. Potential vessel trips and transit routes for undetermined distant ports are addressed in Attachment B.

† GT = gross tonnage; ITC = International Convention on Tonnage Measurement; LT = long ton; T = imperial tons; Te = metric tonne

Table A-2. Regional ports under consideration for project construction and O&M support.

State	Port†	Approximate Travel Distance to RWF (miles)	Construction Crew Mobilization, Surveys and Monitoring	WTG Component Staging	Foundation Staging, Advanced Component Fabrication	General Construction and/or O&M Hub	O&M - Electrical Monitoring and Support§
New York	MON	48	--	--	--	●	--
	JFF	113	●	--	--	●	--
	BRK	175	--	--	--	●	--
Rhode Island	PRV	56	●	●	●	--	●
	DVS, QST	41	--	--	--	●	--
Connecticut	NLD	54	●	●	--	--	--
Virginia	NFK	408	--	●	--	--	--
Massachusetts	NBD	34	●	●	--	--	--
	QNC	195	--	--	--	●	--
Maryland	SPP	581	--	--	●	--	--
New Jersey	PLB	325	--	--	●	--	--

Symbols: ● = port considered for this element, -- = port not considered for this element.

† MON = Port of Montauk, JFF = Port Jefferson, BRK = Port of Brooklyn, PRV = Port of Providence, DVS = Port of Davisville , QST = Quonset Point, NLD = Port of New London, NFK = Port of Norfolk, NBD = New Bedford Marine Commerce Terminal, QNC = Cashman Shipyard (Quincy, MA), SPP = Sparrow's Point, PLB = Paulsboro Marine Terminal

‡ Approximate distance from center of RWF to identified port assuming straight line travel to navigation lane entry (Tech Environmental 2021). Travel distance to Port Jefferson, Brooklyn, Providence, and Cashman Shipyard estimated using similar methods.

§ Monitoring of power transmission and transmission cable performance. O&M vessels may not dispatch from this port.

In addition to the ports shown on this table, vessels used for construction and/or transporting materials may initially travel to the project area from distant ports in Canada, the Gulf of Mexico, Europe, or Asia. These vessels may call on these or other regional ports for inspections, crew transfers, and bunkering before arriving at the Lease Area. Vessel trips from distant ports not listed in this table are discussed in Attachment B to this addendum.

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Attachment B – Analysis of Effects to Listed Species from Vessel Traffic to/from Ports Outside the United States

This attachment summarizes currently available information about potential construction vessels used to construction of Revolution Wind Farm (RWF) and Revolution Wind Export Cable (RWEC), that may originate from currently unidentified ports in the United States and elsewhere in the world. This report assesses potential impacts associated with Project vessel traffic that could originate from yet to be identified ports in the Gulf of Mexico, Canada, Europe, and Asia to Endangered Species Act (ESA) -listed species under National Marine Fisheries Service (NMFS) jurisdiction. Only ESA-listed species that occur along possible vessel routes and potential vessel traffic from foreign ports are assessed in this report. ESA-listed species that occur in the Project action area and all other potential impacts associated with other components of the Project, including potential vessel traffic from domestic ports, are addressed in the BA and Attachment A to this addendum.

1.0 Possible Regions of Origin

Attachment A summarizes the ports under consideration for construction support by vessel class, the total number of vessel trips between these ports by vessel class, and estimated travel distance between these ports and the project area. The ports by vessel class identified Table A-1 can be divided into the following categories:

- Identified ports in RI, MA, CT, and NY
- Other potential ports in NY (Montauk, Brooklyn)
- Other east coast ports identified in the COP (Sparrow's Pt., MD; Paulsboro Marine Terminal, NJ; Norfolk, VA)
- Ports to be determined in the Gulf of Mexico (GOM)
- Ports to be determined in Canada
- Ports to be determined Europe and/or Asia

Vessel trips to currently known or likely ports identified in the COP are described in Attachment A. Related effects to ESA listed species from vessel trips to and from these ports are addressed in the BA. Appendix B in the BA describes currently planned vessel trips to ports to be identified in the Gulf of Mexico and potential effects to ESA listed species in vessel travel corridors. That assessment considered up to 33 potential vessel trips to four yet to be identified ports. As shown in Table A-1, pre-lay grapnel run vessels, supply barges, and survey vessels are the vessel classes most likely to embark from GOM ports. Revolution Wind has decreased the maximum number of vessel trips identified in Appendix B to the BA as potentially originating from the GOM from

33 to 21. However, this number could increase or decrease, depending on the port of origin for the fuel bunkering vessel and how other vessel trips are distributed between the GOM and other identified potential ports.

Vessels that do not originate from the ports identified in Attachment A, Tables A-1 and A-2, or from ports in the GOM may travel with components and equipment directly to the Project area from currently unknown ports on the east coast of Canada, ports on the North Sea or Baltic Sea in Europe, or ports in Asia (Japan, South Korea, Taiwan, or mainland China). A maximum and probable number of trips by vessel class originating from each region can be inferred from Table A-1 and reflects the best available information at this time. This information is summarized in Table B-1.

Table B-1. Vessel classes for Revolution Wind construction and estimated number of vessel trips potentially originating from ports outside the United States.

Vessel Class	Region(s) of Origin	Number of Vessel Trips Over 2-year Project Construction Period		Representative Specifications by Class				
		Maximum Possible	Likely	Length ft (m)	Beam ft (m)	Draft ft (m)	Operating Speed (knots)	Tonnage[†]
Fuel bunkering vessel	Unknown	8	8	295 (90)	62 (19)	17 (5.2)	10	3,500 T
Heavy transport vessel	Canada or Asia	26	6	715 (218)	141 (43)	33 (10)	13.5	50,000 Te
Guard/ Scout Vessel	Asia	8	1	90 (27)	33 (10)	16 (5)	12	700 T

NMFS ESA-listed species occurring along potential travel routes from ports abroad to the Project area are listed in Table B-2. Vessels traveling from ports in Asia may take one of 3 possible routes; through the Suez Canal and the Mediterranean, around South Africa via the Cape of Good Hope, or across the Pacific and through the Panama Canal and the Caribbean Sea and/or GOM.

Table B-2. Threatened and Endangered Species that May Occur in Vessel Transit Areas between Ports of Origin and the Project Area

Species	Scientific Name	Listing Status	Potential Occurrence Port of Origin Routes			
			Gulf of Mexico	Europe	Atlantic Coast	Asia
Sea Turtles						
Green sea turtle	*Chelonia mydas*	Threatened	●	--	●	●
Hawksbill sea turtle	*Eretmochelys imbricata*	Endangered	●	--	●	●
Kemp's ridley sea turtle	*Lepidochelys kempii*	Endangered	●	--	●	●
Leatherback sea turtle	*Dermochelys coriacea*	Endangered	●	●	●	●
Loggerhead sea turtle	*Caretta caretta*	Threatened	●	●	●	●
Olive ridley sea turtle	*Lepidochelys olivacea*	Threatened	--	●	●	●
Fish, Rays, Sharks						
Atlantic salmon, Gulf of Main DPS	*Salmo salar*	Endangered	--	--	●	--
Gulf sturgeon	*Acipenser oxyrinchus desotoi*	Threatened	●	--	--	--
Chinese sturgeon	*Acipenser sinensis*	Endangered	--	--	--	●
Common angelshark	*Squatina squatina*	Endangered	--	●	--	●
Common guitarfish	*Rhinobatos rhinobatos*	Threatened	--	●	--	●
Giant manta ray	*Manta birostris*	Threatened	●	●	●	●
Green sawfish	*Pristis zijsron*	Endangered	--	--	--	●
Narrow sawfish	*Anoxypristis cuspidate*	Endangered	--	--	--	●
Nassau grouper	*Epinephelus striatus*	Threatened	●	--	--	●
Oceanic whitetip shark	*Carcharhinus longimanus*	Threatened	●	●	--	●
Sawback angelshark	*Squatina aculeata*	Endangered	--	--	--	●

Species	Scientific Name	Listing Status	Potential Occurrence Port of Origin Routes			
			Gulf of Mexico	Europe	Atlantic Coast	Asia
Scalloped hammerhead shark	*Sphyrna lewini*	Endangered	--	●	●	●
Smalltooth sawfish	*Pristis pectinate*	Endangered	●	--	--	●
Corals				--	--	
Boulder star coral	*Orbicella franksi*	Threatened	●	--	--	●
Elkhorn coral	*Acropora palmata*	Threatened	●	--	--	●
Lobed star coral	*Orbicella annularis*	Threatened	●	--	--	●
Mountainous star coral	*Orbicella faveolata*	Threatened	●	--	--	●
Pillar coral	*Dendrogyra cylindrus*	Threatened	●	--	--	●
Rough cactus coral	*Mycetophyllia ferox*	Threatened	●	--	--	●
Staghorn coral	*Acropora cervicornis*	Threatened	●	--	--	●
Acropora globiceps	*Acropora globiceps*	Threatened	--	--	--	●
Acropora pharaonis	*Acropora pharaonis*	Threatened	--	--	--	●
Acropora retusa	*Acropora retusa*	Threatened	--	--	--	●
Acropora rudis	*Acropora rudis*	Threatened	--	--	--	●
Acropora speciosa	*Acropora speciosa*	Threatened	--	--	--	●
Acropora tenella	*Acropora tenella*	Threatened	--	--	--	●
Euphyllia paradivisa	*Euphyllia paradivisa*	Threatened	--	--	--	●
Isopora crateriformis	*Isopora crateriformis*	Threatened	--	--	--	●
Montipora australiensis	*Montipora australiensis*	Threatened	--	--	--	●
Pavona diffluens	*Pavona diffluens*	Threatened	--	--	--	●
Porites napopora	*Porites napopora*	Threatened	--	--	--	●

Species	Scientific Name	Listing Status	Potential Occurrence Port of Origin Routes			
			Gulf of Mexico	Europe	Atlantic Coast	Asia
Seriatopora aculeata	*Seriatopora aculeata*	Threatened	--	--	--	●
Seals and Sea Lions						
Mediterranean monk seal	*Monachus monachus*	Endangered	--	--	--	●
Ringed seal – Baltic subspecies	*Phoca hispida*	Endangered	--	●	--	--
Spotted seal	*Phoca largha*	Endangered	--	--	--	●
Whales						
Blue whale	*Balaenoptera musculus*	Endangered	--	●	●	●
False killer whale	*Pseudorca crassidens*	Endangered	--	--	--	●
Fin whale	*Balaenoptera physalus*	Endangered	--	●	●	●
Humpback whale – Western North Pacific DPS	*Megaptera novaeangliae*	Endangered	--	--	--	●
North Atlantic right whale	*Eubalaena glacialis*	Endangered	--	●	●	●
Rice's whale	*Balaenoptera ricei*	Endangered	●	--	--	--
Sei whale	*Balaenoptera borealis*	Endangered	--	●	●	●
Southern right whale	*Eubalaena australis*	Endangered	--	--	--	●
Sperm whale	*Physeter macrocephalus*	Endangered	●	●	●	●

2.0 Species Analysis

This section provides species-specific analysis of potential impacts to ESA-listed species associated with Project vessel traffic that may originate from ports abroad.

Overall, similar to the analysis of potential vessel transits from local ports discussed in the BA, the number of non-local ports under consideration does not increase the number of vessel trips that are likely to occur but may affect the location and length of the transits. In addition, no upgrades or modifications at existing non-local port facility specific to the Project are anticipated

and any upgrades or modifications would serve to support other maritime industries in general. Vessels from these non-local port facilities would also be utilized to serve other maritime industries if they are not a component of the Project.

Finally, individual foreign port facilities annually service thousands of vessels and import and export millions of tons of goods and materials. The vast majority of foreign port facility vessel traffic consists of cargo and container ships, tankers, commercial fishing boats, passenger ships, and private recreational vessels. The vessel types anticipated to be associated with Project construction and operation and maintenance activities are in a vessel category that make up a small insignificant percentage of overall port vessel use.

2.1 Coral Species

The listed species of corals (Table B-2) are not expected to occur within international ports or established vessel channels which are routinely dredged. Known coral reef areas and designated critical habitat of ESA-listed coral species are protected from anchoring and other potential vessel impacts. Such protected areas are in waters that would not be part of transit routes for large vessels and would therefore not be impacted by potential hull and propeller impacts from vessel operations.

Vessels traveling from ports in Europe would not cross any potential coral habitat. Vessels traveling from Asia could encounter coral habitat in 3 areas depending on the travel route: the Caribbean Sea and Gulf of Mexico, the Coral Triangle of Southeast Asia, and the Red Sea. As above, major shipping lanes are physically separated from coral reef habitat. Potential impacts to listed corals are therefore discountable.

2.2 Cetaceans

Blue whale (*Balaenoptera musculus*), false killer whale (*Pseudorca crassidens*), sei whale (*Balaenoptera borealis*), fin whale (*Balaenoptera physalus*), sperm whale (*Physeter macrocephalus*), and humpback whale (*Megaptera novaeangliae*) commonly occur in the open ocean and may be present in Atlantic Ocean vessel transit routes between Europe and the United States. Other global populations could occur in all potential vessel transit routes between Asia and the United States, including passage through the Panama or Suez Canals. Southern right whale (*E. australis*) have a circumpolar distribution in the Southern Ocean and the southernmost regions of the Atlantic, Indian, and Pacific Oceans. This species would only be exposed to project-related vessel traffic in the unlikely event that vessels traveled to the project area from Asia using southerly routes around Cape Horn or the Cape of Good Hope.

Based on currently available information, a maximum of less than 50 vessel trips could originate from ports in Europe or Asia. More likely, less than 20 vessel trips would originate from these regions over the two-year construction period. The commercial vessels used for project construction are unlikely to remain idle in the absence of the proposed action; these vessels

would likely be contracted to other projects in the global marketplace. Even if every vessel originated from the same region and traveled the same route to the project area, the proposed action would result in a negligible increase in baseline levels of vessel traffic. In this context, BOEM considers the risk of an individual marine mammal encounter with project vessels in open ocean transit routes to be discountable.

Appendix B to the BA evaluated the potential effects of up to 33 construction vessel trips to the Gulf of Mexico. As stated, Revolution Wind has reduced that estimate to 21 vessel trips but has not specified which of up to four potential ports could be used. As such, the analysis presented in Appendix B to the BA remains applicable to the reduced number of vessel trips presented here. Sperm whales and Rice's whales (*Balaenoptera ricei*) could potentially occur in the vessel transit route between Gulf of Mexico non-local ports on the way toward the Straits of Florida and to the Project area or on a return trip in vessels that do not remain in the Project area. Sperm whale occurrence is more diverse throughout deep waters of the Gulf of Mexico and may overlap with vessel transit areas. Rice's whale distribution is much smaller and limited to the eastern area of the Gulf of Mexico in depths between about 330 feet (100 meters) and about 1,310 feet (400 meters). Most vessels would likely originate from ports west of the mouth of the Mississippi River and would not overlap with Rice's whales. There is no designated critical habitat for sperm or Rice's whales.

The current estimate of up to 21 potential construction trips between the Gulf of Mexico and the Project area over the lifetime of the Project are very low as compared to total regional vessel trips. Project mitigation measures include the implementation of NOAA vessel guidelines for marine mammal and sea turtle strike avoidance measures, including vessel speed restrictions. These measures would effectively avoid and minimize the likelihood of encountering and striking whales, such that the likelihood of sperm or Rice's whale injury or mortality is discountable. See the BA for additional information and assessment of potential impacts to the sperm whale species in the action area outside the Gulf of Mexico.

The Revolution Wind project area is located in habitats known to be used by the North Atlantic right whale (NARW, *Eubalaena glacialis*). As such, the species is likely to occur in all vessel transit routes that originate within the project area. The refined vessel traffic estimates presented in Attachment A increase the total number of vessel trips to 1,375 (consolidating barge and tow-tug trips) compared to the 1,351 presented in the January 30, 2023 version of the BA. This equates to approximately 12 additional vessel trips per year over the two-year construction period. BOEM concludes that this modest increase in vessel traffic would not substantively change the findings of the vessel traffic impact analysis for any marine mammal species presented in the BA. However, we are revising this analysis to incorporate potential effects on designated critical habitat for NARW.

Proposed vessel transit routes to and from the Cashman Shipyard, a facility in Quincy, MA, and transit routes from potential ports in Canada would or could travel through designated critical

habitat for this species. It is not possible for vessels traveling to the project area from Cashman Shipyard to avoid travel through NARW critical habitat Unit 1, the Northeastern U.S. Foraging Area, which covers the entirety of and extends seaward of the Gulf of Maine to the boundary of the U.S. Exclusive Economic Zone (EEZ) (81 FR 4838). In addition, Revolution Wind estimates that some portion of up to 26 heavy transport vessel trips required for project construction could originate from unknown ports in Canada (see Attachment A, Table A-1). Vessels originating from Canadian ports could select transit routes that avoid critical habitat Unit 1 but may elect not to for economic reasons. Vessel transit routes to other identified or currently unknown ports are unlikely to transit NARW critical habitat Unit 2. This unit comprises the Southeastern U.S. Calving Area, located along the southern U.S. Atlantic Coast between Cape Fear and Cape Canaveral. Unlike Unit 1, the most probable vessel transit routes between the project area and the GOM or Panama Canal are located seaward of Unit 2 (BOEM, NOAA, and USCG 2022).

As defined in 81 FR 2838, the physical and biological features of right whale calving habitat that are essential to the conservation of NARW are: (1) Calm sea surface conditions of Force 4 or less on the Beaufort Wind Scale; (2) sea surface temperatures from a minimum of 7 °C, and never more than 17 °C; and (3) water depths of 6 to 28 meters, where these features simultaneously cooccur over contiguous areas of at least 231 nm^2 of ocean waters during the months of November through April. When these features are available, they are selected by right whale cows and calves in dynamic combinations that are suitable for calving, nursing, and rearing, and which vary, within the ranges specified, depending on factors such as weather and age of the calves. Project-related vessel traffic to and from the Cashman Shipyard and potential ports in Canada would have no measurable effect on the physical and biological features of designated NARW critical habitat. Therefore, the proposed action would have no effect on critical habitat for this species.

2.3 Seals

Ships traveling from ports in the Baltic or North Sea may pass through the range of the ESA-listed Baltic subspecies of ringed seal (*Phoca hispida*). Likewise, vessels traveling from some ports in Japan or South Korea may cross the habitat of spotted seal (*Phoca larga*). Any ships traveling from Asia through the Suez Canal and Mediterranean Sea may encounter Mediterranean monk seal (*Monachus monachus*) habitat. As with cetaceans, NOAA vessel guidelines to minimize marine mammal strikes would effectively avoid and minimize the likelihood of vessel strikes for pinniped species along international transit routes. The likelihood of injury or mortality to ESA-listed pinniped species is therefore discountable.

2.4 Fish, Rays, and Sharks

Several bony fish species have ranges that may overlap with vessel traffic from ports abroad, but they are extremely unlikely to interact directly with ships traveling to the Project area. Chinese sturgeon (*Acipenser sinesnsis*) are amphidromous, meaning they spawn and rear in freshwater and forage in both the estuary of their natal rivers and shallow marine habitats in close proximity

to the estuary. While vessels traveling from ports in mainland China may overlap with the documented range of this species, the extremely low number of individuals makes any threat to Chinese sturgeon discountable.

Atlantic salmon (*Salmo salar*) are anadromous, meaning they spawn and rear in freshwater and migrate to the ocean to mature to adulthood. Gulf of Maine DPS of Atlantic salmon (*Salmo salar*) are likely to occur in potential vessel transit routes from ports of origin on the east coast of Canada. Vessel strikes have not been identified as a risk factor for this species. In theory, up to 26 vessel trips to the project area could originate from Canadian ports. The likely number is far lower – 6 or less. These vessels would travel on established travel corridors supporting thousands of vessel trips per year (BOEM, NOAA, and USCG 2022). Given the limited risk of vessel strikes and the diminishingly small increase in baseline vessel traffic conditions attributable to the project, project-related vessel strikes pose an insignificant and discountable risk to the Gulf of Maine DPS of Atlantic salmon.

Nassau grouper (*Epinephelus striatus*) are not likely to be at risk of vessel strikes from vessel transits through the Straits of Florida enroute from the Panama Canal. The risk of a vessel strike resulting from the Project is also considered discountable because vessel strikes of marine fish offshore are rare events in general and not considered a threat to Nassau grouper. There is no designated critical habitat for Nassau grouper. While it is possible that the presence of vessels may result in a short-term behavioral response from this species (e.g., startle, dive), the effects are not expected to result in any injury or reduced fitness of individuals. Therefore, potential effects to Nassau grouper from vessel strikes are discountable.

Vessel strikes of elasmobranch species, in general, are extremely rare. Giant manta rays (*Manta birostris*) are found in open water, feeding over reefs, or visiting shallow-water cleaning stations in certain areas. Oceanic whitetip sharks (*Carcharhinus longimanus*) and scalloped hammerhead sharks (*Sphyrna lewini*) tend to prefer the deeper ocean waters where there is no likelihood of vessel strike. Although oceanic whitetips have been observed in waters as shallow as 120 feet (36 meters) and along coastlines, they tend to only hunt in these waters if they are near a continental shelf where they still have access to deeper waters. There is no designated critical habitat for giant manta rays, oceanic whitetip sharks, or scalloped hammerhead sharks.

Smalltooth sawfish (*Pristis pectinata*) vessel encounters would be rare, and their designated critical habitat is outside the anticipated areas of vessel transit routes. Small, juvenile smalltooth sawfish are generally restricted to estuarine waters of peninsular Florida, whereas larger adults have a broader distribution and could be found in the southeastern Gulf of Mexico.

Common angelshark (*Squatina squatina*), common guitarfish (*Rhinobatos rhinobatos*), green sawfish (*Pristis zijstron*), narrow sawfish (*Anoxypristis cuspitata*), and sawback angelshark (*Squatina aculeata*) are all bottom-dwelling predators. While their geographic ranges may overlap with surface vessel traffic from Asia through the Suez or Panama canals, there is very

low probability of direct interaction between vessels and any of these elasmobranch species. Impacts on these species is therefore discountable.

In addition to the species identified above, gulf sturgeon (*Acipenser oxyrinchus desotoi*) are likely to occur in vessel transit routes originating from potential project ports on the Gulf of Mexico. Potential effects to this species from this component of vessel traffic are addressed in Appendix B to the Biological Assessment. Vessels traveling to the project area through the Panama Canal are likely to use deepwater shipping lanes between Florida and the northern coast of Cuba in the southern Gulf of Mexico (BOEM, NOAA, and USCG 2022). These routes are outside of known and probable marine habitats for gulf sturgeon, which are concentrated in nearshore and estuarine waters less than 40 feet deep in the northern Gulf of Mexico less than 40 feet deep (Ross et al. 2009).

Overall, there is a very small likelihood that the fish species listed above would be expected to occur within the Gulf of Mexico, Mediterranean Sea, Caribbean Sea, or open ocean vessel transit areas and occur at or near the surface at the same time vessels associated with the Project may be present. Additionally, only a small number of trips between international ports and the Project area may potentially occur over the lifetime of the Project. This low likelihood of interaction results in an unlikely occurrence of a vessel strike to one of these species. Based on the best available information on vessel strike risks associated with the Project, the risk of vessel strikes with a giant manta ray, oceanic whitetip shark, smalltooth sawfish is extremely unlikely to occur and the potential effects from vessel strikes is considered to be discountable. See the BA for additional information and assessment of potential impacts to the giant manta ray species in the action area outside the international transit routes discussed herein.

2.5 Sea Turtles

In general, all species of sea turtles are susceptible to vessel strike, but this susceptibility is likely dependent upon a number of factors including geographic area, water depth, species surface patterns, and number of vessel trips. For example, hawksbill sea turtles (*Eretmochelys imbricata*) could be present in vessel transit area originating or returning to ports in the Gulf of Mexico, Europe, or Asia. This species is rare and expected to be present at low densities and in the deeper water transit routes from distant ports compared to other sea turtle species. Loggerhead sea turtle (*Caretta caretta*) designated critical habitat is located within potential vessel transit routes for the Project. Designated critical habitat for green (*Chelonia mydas*), hawksbill, and leatherback (*Dermochelys coriacea*) sea turtles are outside the potential areas of vessel transit routes and there is no designated critical habitat for Kemp's ridley sea turtle (*Lepidochelys kempii*).

Considering few estimated construction trips between the ports abroad and the Project area may potentially occur over the lifetime of the project, the likelihood of encountering and striking a sea turtle in the Gulf of Mexico, Caribbean Sea, Mediterranean Sea, or open Indian, Atlantic, or Pacific Ocean is extremely low based on the low level of vessel activity expected relative to the

overall vessel transit. This low likelihood of interaction results in an unlikely occurrence of a vessel strike to any species of sea turtle. In addition, Project mitigation measures include the implementation of NOAA vessel guidelines for marine mammal and sea turtle strike avoidance measures, including vessel speed restrictions. These measures would effectively avoid and minimize the likelihood of vessel strike. Based on the best available information, the risk of vessel strikes with sea turtles for vessels traveling from international ports is extremely unlikely to occur and will be discountable. See the BA for additional information and assessment of potential impacts to the sea turtle species in the action area.

3.0 Conclusion

In conclusion, the overall number of vessel trips between the international ports and the Project area is expected to be very low over the lifetime of the Project. In addition, the vessel types anticipated to be associated with Project construction and operation and maintenance activities are in a vessel category and frequency that make up a small percentage of overall port vessel transit activity. There are no or very limited reports of vessel strikes to listed species from total baseline vessel activities. Considering the number of vessel trips associated with the Project, species occurrences, and species-specific risk factors, the potential for vessel strikes on listed species in international or foreign waters is insignificant (locally) or discountable (from outside the region).

4.0 Reference

BOEM, NOAA, and USCG (Bureau of Ocean Energy Management, National Oceanic and Atmospheric Administration, and U.S. Coast Guard). 2022. AccessAIS. Web-based AIS data viewer. Available at: **https://marinecadastre.gov/accessais/**. Accessed: October 25, 2022.

Ross, S.T., W.T. Slack, R.J. Heise, M.A. Dugo, H. Rogillio, B.R. Bowen, P. Mickle, and R.W. Heard. 2009. Estuarine and coastal habitat use of Gulf Sturgeon (*Acipenser oxyrinchus desotoi*) in the North-Central Gulf of Mexico. *Estuaries and Coasts* 32: 360-374.

Attachment C – Planned Monitoring, and Mitigation Measures

1.0 Introduction

This attachment describes planned mitigation and monitoring measures to avoid and minimize impacts to ESA-listed species from the construction and O&M of the Revolution Wind project. The mitigation measures described in this attachment comprise the environmental protection measures (EMPs) proposed by the lessee in the COP, and additional known or anticipated mitigation requirements imposed by BOEM and other regulatory agencies. The intent of this attachment is to provide additional detail requested by NMFS regarding how these EPMs and mitigation measures will be implemented.

EPMs are defined as:

- Design mitigation measures, monitoring, or other activities proposed by Revolution Wind to avoid and minimize adverse effects from project construction and O&M on ESA-listed species.
- EPMs are part of the proposed action and are considered in the analysis of effects to ESA-listed species.

Mitigation measures comprise:

- The methods used to implement EPMs and other mitigation requirements.
- The personnel, equipment, and protocols that will implement these methods (e.g., construction crew members that install and operate sound attenuation devices).
- Procedures used to implement mitigation measures (e.g., shutdown protocols for impact pile driving and/or vessel speed restrictions when marine mammals are detected).

Monitoring measures comprise the following:

- The protected species observers (PSOs) who monitor clearance and shutdown zones and issue alerts when protected species are or may be present.
- The visual and acoustic equipment used by PSOs to monitor the project area and surroundings for protected species presence in or near pre-clearance and shutdown zones.
- Monitoring areas, pre-clearance and shutdown zones, and communication protocols for mitigation measure implementation.
- The data collection and reporting methods used to document mitigation measure implementation and, where necessary, protected species occurrence.

Additional mitigation is defined as:

- Other known or anticipated measures required by BOEM and/or other regulatory agencies via NMFS to avoid and minimize adverse effects on ESA-listed and other protected species.
- Additional mitigation measures are not part of the proposed action and have not been considered in the analysis of effects to ESA-listed species.

EPMs and associated mitigation and monitoring measures applicable to ESA-listed species listed in Table C-1. EPMs were obtained from the Protected Species Monitoring and Mitigation Plan (PSMMP, Revolution Wind 2022), the Petition for Incidental Take Regulations (ITR, LGL 2022), the Fisheries and Benthic Monitoring Plan (Inspire Environmental 2022), the COP, additional information provided by Revolution Wind, and the Cooperating Agency review version of the Revolution Wind Final Environmental Impact Statement. These EPMs were supplemented with additional information where available. Revolution Wind (2022) has indicated that a separate PSMMP detailing proposed mitigation and monitoring measures for sea turtles and other protected species (i.e., Atlantic cod) is currently in development. This document will be provided to BOEM as an addendum to the COP. BOEM will make this plan available to NMFS after internal review and approval is complete.

In addition to the EPMs listed in Table C-1, BOEM is proposing mitigation measures to further avoid and minimize impacts to ESA-listed species and provide clear protocols for monitoring and reporting incidental take. These additional mitigation measures are listed in Table C-2.

Table C-1. EPMs proposed by Revolution Wind to Avoid and Minimize Effects on ESA-listed and other Protected Species.

E3PM #	EPM	Description	Project Phase	Anticipated Effect
1	PSO/ Passive acoustic monitoring (PAM) training and requirements	Dedicated personnel may be required for carrying out mitigation and monitoring efforts onboard Project vessels. These roles are generally required to be filled by NMFS-approved and BOEM-accepted PSOs and passive acoustic monitoring (PAM) operators. Personnel in the field have a responsibility to support these activities and will receive Project -specific training. A Permits and Environmental Compliance Plan (PECP) manual which will include the PSMMP will be prepared to describe species expected to occur in the Project Area, monitoring and mitigation measures, data collection and reporting measures, equipment specifications, etc. The Project will conduct standardized pre-activity environmental awareness training for all crew members. Protected species observers (PSOs) will, at a minimum, meet the observer standards outlined in Baker et al. (2013) and will have the appropriate approvals from NMFS including: • At least one PSO must have prior experience performing the duties of a PSO during construction activity pursuant to a NMFS-issued incidental take authorization; and • Other PSOs may substitute other relevant experience, education, or training for prior experience performing duties of a PSO during construction activity pursuant to a NMFS-issued take authorization. The PSO team will comprise a sufficient number of individuals with appropriate skills necessary to meet all mitigation and monitoring requirements. The lead monitor (Lead PSO) will identified by the applicant for approval by NMFS prior to initiation of monitoring activities. The Lead PSO will have experience on similar projects in the northwestern Atlantic Ocean. The PSO team may also include a supervisor who may work in the field or shore side to provide additional support as needed for the duration of monitoring and mitigation activities. The supervisor will facilitate communication between PSOs and other parties involved in project construction. All PSOs will have relevant experience on similar projects and suitable expertise with monitoring software and equipment. In addition to PECP training, all PSOs will also complete a two-day training and refresher session. The two-day training will review the protected species anticipated to occur and associated regulatory requirements. The refresher session will be tailored to the specific needs and composition of the PSO team.	Construction	PSOs and PAM operator training will facilitate avoidance and minimization of potential adverse effects to ESA-listed species from vessel interactions, HRG surveys, UXO detonation, and pile driving by ensuring monitoring and mitigation measure effectiveness.
2	Recording and reporting – Data recording protocols	PSOs, PAM operators, and crew members (as applicable) will record all sightings of marine mammals and other protected species observed anywhere within an applicable monitoring zone. For mitigation monitoring, data on all PSO observations will be recorded based on standard PSO data collection requirements and specific permit conditions. A data collection software system (e.g., Mysticetus ™ or similar software) will be used to record and collate data obtained from visual and acoustic observations during mitigation monitoring. The PSOs and PAM operators will enter the data into the selected data entry program installed on field laptops/tablets. PSO data records will include, but are not limited to: • The presence and location (if determinable) of any ESA-listed marine mammal or sea turtle detected by PSOs, PAM operators, or crew members. • Identification of marine mammal species, numbers of individuals, and behaviors as able. PAM detections are rarely suitable for enumeration or behavior of animals unless verified by visual detections. • Detections will be annotated with information regarding vessel activity, environmental conditions, and by other operational parameters (e.g., number of vessels in areas, equipment start and stop times, operational duration, etc.). • Size of all regulatory and monitoring zones. • Implementation of vessel strike avoidance measures. • Implementation of clearance, ramp-up and soft start, and shutdown measures as applicable for shutdown and monitoring zones. • Implementation of specific NARW mitigation measures. • • Observations of any potential injured or dead protected species. The following information about each protected species detection will be carefully and accurately recorded: • Species, group size, age/size/sex categories (if determinable), and physical description of features that were observed or determined not to be present in the case of unknown or unidentified animals; • Behavior when first sighted and during any subsequent sightings; • Heading (if consistent), bearing, and distance from observer; • Location of confirmed acoustic detections within Project Area (if PAM operator is able to localize the animal); • Tracks of marine mammals derived from PAM systems if accurate localization is attainable; • Entry of animal into any regulatory or monitoring zones and duration in those zones; • Closest point of approach to the applicable activities and/or vessels and assets;	Construction, O&M, decommissioning	Clear data management and reporting protocols will provide for accurate tracking of potential adverse effects to ESA-listed species from vessel interactions, HRG surveys, UXO detonation, and pile driving. This will help to ensure monitoring and mitigation measure effectiveness.

E3PM #	EPM	Description	Project Phase	Anticipated Effect
		• Apparent reaction to activities (e.g., none, avoidance, approach, paralleling, etc.) with annotations regarding animal headings, pace, or other information that could help assess changes in behavior; • Time, location, speed, and Project activity/active sound sources in operation; • How the animal was detected (i.e., with what monitoring method) and if the animal was detected by any other monitoring method; and • Mitigation measures requested and implemented (if any). At regular intervals and at each detection the following information will be recorded by PSOs and PAM operators when the information is determinable: • Sea state, visibility, and sun glare; • Noise performance of PAM systems and effective detection ranges for species; • Vessel or Project activities and location (if mobile); • PSO shift changes; • Monitoring equipment being used; and • Any NARW SMA or DMAs placed during that particular watch.		
3	Recording and reporting – Reporting requirements	The following situations would require immediate reporting to appropriate POCs: • If a stranded, entangled, injured, or dead protected species is observed, the sighting shall be reported within 24 hours to the NMFS RWSAS hotline. • In the event a protected species is injured or killed as a result of Project activities, the vessel captain or PSO on board shall call for an immediate cessation of all activities until NMFS Office of Protected Resources (OPR) is able to review the circumstances of the incident and determine what, if any, additional measures are appropriate to ensure compliance. Additionally the vessel captain or PSO on board shall report immediately to: • NMFS OPR (301-427-8401) and Greater Atlantic Regional Fisheries Office no later than within 24 hours; • NOAA Fisheries Marine Mammal and Sea Turtle Stranding and Entanglement Hotline (866-755-6622) or alternative electronic reporting systems as approved by the NOAA stranding program, as well as the U.S. Coast Guard. • Any NARW sightings should be reported as soon as feasible and no later than within 24 hours to the NMFS RWSAS hotline or via the Whale Alert Application. Data and Final Reports will be prepared using the following protocols: • All vessels will utilize a standardized data entry format. • A QA/QC'd database of all sightings and associated details (e.g., distance from vessel, behavior, species, group size/composition) within and outside of the designated shutdown zones (SZs), monitoring effort, environmental conditions, and Project-related activity will be provided after field operations and reporting are complete. This database will undergo thorough quality checks and included all variables required by the NMFS-issued Incidental Take Authorization (ITA) and BOEM Lease OCS-A 0486 and will be required for the Final Technical Report due to BOEM and NMFS. • During construction, weekly reports briefly summarizing sightings, detections, and activities will be provided to NMFS and BOEM on the Wednesday following a Sunday-Saturday period. • Final reports will follow a standardized format for PSO reporting from activities requiring marine mammal mitigation and monitoring. • An annual report will be provided to NMFS and to BOEM on April 1 every calendar year summarizing the prior year's activities. • A draft and final HRG survey report will be submitted to BOEM and NMFS post-construction and every year following the completion of O&M HRG surveys. The final report must address any comments on the draft report provided to Revolution Wind by BOEM and NMFS. The report must include a summary of survey activities, all PSO and incident reports, and an estimate of the number of listed marine mammals or sea turtles observed and/or taken during these survey activities.	Construction, O&M, Decommissioning	Same as above
4	General PSO measures	The following visual observation protocols will be implemented by all PSOs employed on Project vessels: • Visual monitoring of established clearance and SZs will be performed by PSO teams on each survey vessel. • Observations will take place from the highest available vantage point on all the survey vessels. General 360° scanning will occur during the monitoring periods, and target scanning by the PSO will occur if cued to a marine mammal. PSOs will adjust their positions appropriately to ensure adequate coverage of the clearance and SZs around the respective sound sources. • PSOs will work in shifts such that no one PSO will work more than 4 consecutive hours without a 2-hour break or longer than 12 hours during any 24-hour period.	Construction, O&M, Decommissioning	These measures ensure that PSOs can effectively monitor for marine wildlife and that the appropriate agencies are contacted in the event of a NARW sighting. Collectively these measures minimize the

E3PM #	EPM	Description	Project Phase	Anticipated Effect
		• The PSOs will begin observation of clearance zones (CZs) prior to initiation of HRG survey operations and will continue observation of the shutdown throughout the survey activity and for 30 minutes following cessation of the survey activity using equipment operating below 180 kHz. • The PSOs will be responsible for visually monitoring and identifying marine mammals approaching or entering the established zones during survey activities. • PSOs will systematically scan with the naked eye and a 7 x 50 reticle binocular, supplemented with night-vision equipment when needed. • When monitoring at night or in low visibility conditions, PSOs will monitor for marine mammals and other protected species using night-vision goggles with thermal clip-ons, a hand-held spotlight, and/or a mounted thermal camera system. • Activities with larger monitoring zones will use 25 x 150 mm "big eye" binoculars. • The PSO(s) on duty will be responsible to communicate the presence of marine mammals as well as to communicate the recommended mitigation action(s) that are necessary to ensure mitigation and monitoring requirements are implemented as appropriate. • Vessel personnel will be instructed to report any sightings to the PSO team as soon as they are able, and it is safe to do so. • Members of the monitoring team will consult with NMFS' North Atlantic right whale reporting system for the presence of North Atlantic right whales in the Project area. • If a NARW is involved in any of the above-mentioned incidents, then the vessel captain or PSO onboard should also notify the Right Whale Sighting Advisory System (RWSAS) hotline immediately and no later than within 24 hours. • PSOs will monitor Mystecetus (or similar data system) and/or appropriate data systems for DMAs established within their survey area. • PSOs will also monitor the NMFS NARW reporting systems including Whale Alert and RWSAS once every PSO shift during Project-related activities within, or adjacent to, seasonal management areas (SMAs) and/or dynamic management areas (DMAs). It will be the responsibility of the PSO(s) on duty to communicate the presence of protected species as well as to communicate the recommended mitigation action(s) that are necessary to ensure mitigation and monitoring requirements are implemented as appropriate.		potential for adverse effects to ESA-listed species.
5	PSO protocols for normal and low visibility conditions	The lead PSO will determine if conditions warrant implementing reduced visibility protocols. Under normal visibility conditions, visual monitoring will be conducted as follows: • One PSO on watch during pre-clearance periods and all source operations. • PSOs will use reticle binoculars and naked eye to scan the monitoring zone for marine mammals. Under nighttime or low visibility conditions, visual monitoring will be conducted as follows: • Two PSOs will remain on watch during pre-clearance periods, all operations, and for 30 minutes following use of HRG sources operating below 180 kHz. • Each PSO should use the most appropriate available technology (e.g., EO/IR camera and/or night vision device) and viewing locations to monitor clearance and SZs and maintain appropriate vessel separation distances.	Construction, O&M, Decommissioning	These measures ensure that PSOs can effectively monitor for marine wildlife and that the appropriate agencies are contacted in the event of a NARW sighting. Collectively these measures minimize the potential for adverse effects to ESA-listed species.
6	Vessel Strike Avoidance Policy – General Measures	The Project will implement a vessel strike avoidance policy for all vessels under contract to Ørsted to reduce the risk of vessel strikes and the potential of death and/or serious injury to marine mammals. In addition to vessels transiting and working (e.g., HRG surveys, construction, O&M) within the Project Area, there will be vessels transiting to and from the Project Area transporting materials, equipment, and personnel. All vessels will comply with the vessel strike avoidance measures as specified below, except under extraordinary circumstances when complying with these requirements would put the safety of the vessel or crew at risk. 1. Vessel operators and crews shall receive protected species identification training. This training will cover sightings of marine mammals and other protected species known to occur or which have the potential to occur in the Project Area. It will include training on making observations in both good weather conditions (i.e., clear visibility, low wind, low sea state) and bad weather conditions (i.e., fog, high winds, high sea states, glare). Training will include not only identification skills but information and resources available regarding applicable federal laws and regulations for protected species. It will also cover any Critical Habitat requirements, migratory routes, seasonal variations, behavior identification, etc. 2. Vessel operators and crews will maintain a vigilant watch for marine mammals and other protected species and change course or respond with the appropriate action (e.g., slow down) to avoid striking marine mammals. 3. Vessel operators will monitor the Project's Situational Awareness System and the Coast Guard VHF Channel 16 as well as the Whale Alert and the NMFS RWSAS for the presence of NARWs once every PSO shift during Project-related activities. 4. All vessels will comply with NMFS regulations and speed restrictions and state regulations as applicable for NARW. 5. All vessels 65 ft (20 m) or longer subject to the jurisdiction of the U.S. will comply with the 10-knot speed restriction when entering or departing a port or place subject to U.S. jurisdiction. This includes any vessel 65 ft or longer travelling in any NARW seasonal management area (SMA) when speed restrictions are in effect.	Construction, O&M, decommissioning	Training of crew and personnel would minimize the potential for adverse effects to ESA-listed species by increasing the effectiveness of mitigation and monitoring measures through educational and training materials and avoiding vessel interactions with ESA-listed species.

E3PM #	EPM	Description	Project Phase	Anticipated Effect
7	Vessel separation distances	Vessels will maintain, to the extent practicable, separation distances of: • >500 m distance from any sighted NARW or unidentified large marine mammals during impact pile driving; • >100 m from all other whales for all other construction activities; • >50 m (54 yards) for dolphins, porpoises, seals, and sea turtles. Specific requirements that will be implemented should an animal enter the vessel separation distance are outlined below in EPMs 8, 9, and 10.	Construction, O&M, decommissioning	This mitigation and monitoring measure would minimize the potential for adverse effects on marine mammals and sea turtles resulting from vessel interactions.
8	Vessel strike avoidance – Base conditions	All personnel working offshore will receive training on marine mammal, sea turtle, and Atlantic sturgeon awareness and vessel strike avoidance measures. All vessels will adhere to current NOAA vessel guidelines for approach distances and mandatory measures stipulated in regulations governing the approach to North Atlantic Right Whales and the Right Whale Speed Rule. (Note: Voluntary measures within a DMA are addressed separately in the Standard and Adaptive Plan detailed below). Approach Constraints • All species o No vessels underway will divert or alter course in order to approach marine mammals under observation. o Any vessel underway must avoid excessive speed or abrupt changes in direction. o When a marine mammal(s) is sighted while a vessel is underway, the vessel must take action as necessary to avoid violating the relevant separation distances • Exceptions: o Limitations on approach do not apply where compliance would create an imminent and serious threat to a person, vessel, or aircraft o Limitations on approach do not apply when approaching to investigate an entanglement or injury, or to assist in the disentanglement or rescue of a whale, provided that permission is received from NMFS or a NMFS designee prior to the approach o Limitations on approach do not apply to the extent that a vessel is restricted in her ability to maneuver, and because of the restriction, cannot comply with the limitation on approach. • North Atlantic Right Whale o By regulation (50 CFR §224.103(c)), approach (including by interception) within 500 yards (460 m) of a right whale by vessel, aircraft, or any other means is prohibited. o If within 500 yards (460 m) of a right whale: (1) If underway, a vessel must steer a course away from the right whale and immediately leave the area at a slow safe speed; o Exceptions stated in the “All Species” section above are applicable for NARW. • Other Large Whales o Vessel speeds will immediately be reduced to 10 knots or less when any large whale, mother/calf pair, or large assemblage of non-delphinoid cetaceans is observed within 100 m of a vessel underway. o All vessels must maintain a minimum separation distance of 100 m from sperm whales and non-NARW baleen whales. If one of these species is sighted within 100 m of an underway vessel, that vessel must shift the engine to neutral. Engines must not be engaged until the whale has moved outside of the vessel’s path and beyond 100 m. • Dolphins, porpoises, seals o All vessels must, to the maximum extent practicable, attempt to maintain a minimum separation distance of 50 m from all delphinoid cetaceans and pinnipeds. If a delphinoid cetacean or pinniped is sighted within 50 m of an underway vessel, that vessel must shift the engine to neutral. Engines must not be engaged until the animal(s) has moved outside of the vessel’s path and beyond 50 m. o Exception to separation distance and shifting engines to neutral for delphinoid cetaceans and pinnipeds that approach the vessel (e.g., bow-riding dolphins).	Construction, O&M, decommissioning	This mitigation and monitoring measure would minimize the potential for ship strikes and impacts to marine mammals. Communication between Project vessels would further reduce potentially adverse effects by alerting vessels to the presence of marine mammals in the area.
9	Vessel strike avoidance – Standard plan	Implement Base Conditions described above. • **Between November 1st and April 30th**: Vessels of all sizes will operate port to port (from ports in NY, CT, RI and MA) at 10 knots or less. Vessels transiting from other ports outside those described will operate at 10 knots or less when within any active Seasonal Management Area (SMA) or within Lease Area and RWEC corridor. • **Year Round**: Vessels of all sizes will operate at 10 knots or less in any Dynamic Management Areas (DMAs). • **Between May 1st and October 31st:** All underway vessels (transiting or surveying) operating at >10 knots will have a dedicated visual observer (or NMFS approved automated visual detection system) on duty at all times to monitor for marine mammals within a 180° direction of the forward	Construction, O&M, decommissioning	This mitigation and monitoring measure would minimize the potential for ship strikes and impacts to NARW by implementing special measures in SMAs and DMAs.

E3PM #	EPM	Description	Project Phase	Anticipated Effect
		path of the vessel (90° port to 90°starboard). Visual observers must be equipped with alternative monitoring technology for periods of low visibility (e.g., darkness, rain, fog, etc.). The dedicated visual observer must receive prior training on protected species detection and identification, vessel strike minimization procedures, how and when to communicate with the vessel captain, and reporting requirements. Visual observers may be third-party observers (i.e., NMFS-approved PSOs) or crew members.		
10	Vessel strike avoidance – Adaptive plan	The Standard Plan outlined above will be adhered to except in cases where crew safety is at risk, and/or labor restrictions, vessel availability, costs to the project, or other unforeseen circumstance make these measures impracticable. To address these situations, an Adaptive Plan will be developed in consultation with NMFS to allow modification of speed restrictions for vessels. Should Revolution Wind choose not to implement this Adaptive Plan, or a component of the Adaptive Plan is offline (e.g., equipment technical issues), Revolution Wind will default to the Standard Plan (described above). The Adaptive Plan will not apply to vessel subject to speed reductions in SMAs as designated by NOAA's Vessel Strike Reduction Rule. Proposed measures may include: Implement Base Conditions described above. **Year Round:** A semi-permanent acoustic network comprising near real-time bottom mounted and/or mobile acoustic monitoring platforms will be installed such that confirmed North Atlantic right whale detections are regularly transmitted to a central information portal and disseminated through the situational awareness network. • The transit corridor and WDA will be divided into detection action zones. o Localized detections of NARWs in an action zone would trigger a slow-down to 10 knots or less in the respective zone for the following 12 h. Each subsequent detection would trigger a 12-h reset. A zone slow-down expires when there has been no further visual or acoustic detection in the past 12 h within the triggered zone. • The detection action zones size will be defined based on efficacy of PAM equipment deployed and subject to NMFS approval as part of the NARW Vessel Strike Avoidance Plan. **Year Round:** All underway vessels (transiting or surveying) operating >10 knots will have a dedicated visual observer (or NMFS approved automated visual detection system) on duty at all times to monitor for marine mammals within a 180° direction of the forward path of the vessel (90° port to 90°starboard). Visual observers must be equipped with alternative monitoring technology for periods of low visibility (e.g., darkness, rain, fog, etc.). The dedicated visual observer must receive prior training on protected species detection and identification, vessel strike minimization procedures, how and when to communicate with the vessel captain, and reporting requirements. Visual observers may be third-party observers (i.e., NMFS-approved PSOs or crew members). **Year-round:** any DMA is established that overlaps with an area where a project vessel would operate, that vessel, regardless of size when entering the DMA, may transit that area at a speed of >10 knots. Any active action zones within the DMA may trigger a slow down as described above. If PAM and/or automated visual systems are offline, the Standard Plan measures will apply for the respective zone (where PAM is offline) or vessel (if automated visual systems are offline).	Construction, O&M, decommissioning	This mitigation and monitoring measure would minimize the potential for ship strikes and impacts to NARW by implementing adaptive measures in response to observed conditions.
11	Long-term monitoring – marine mammals	• Pre-construction marine mammal surveys will provide a baseline set of data for comparison against the monitoring efforts during construction. • Post-construction marine mammal surveys will provide for an assessment of the potential long-term impacts of the Project. • Survey will involve a combination of visual and acoustic monitoring techniques	Pre-Construction, Construction, O&M, Decommissioning	These surveys can be used to assess the potential long-term impacts that the Project may have on marine mammal populations in the Offshore Wind Area.
12	Operational monitoring – Marine mammals	• Visual monitoring and PAM for marine mammals will occur during vessel transits to and from the Project area as described above under vessel speed restrictions (standard and adaptive plans)	Construction, O&M, decommissioning	This mitigation and monitoring measure would minimize the potential for adverse effects on marine mammals and sea turtles resulting from vessel interactions.
13	Long-term Monitoring - Turtles	Visual monitoring will be employed to assess the potential impacts of the Project on sea turtles in the Project area. Pre-construction surveys will provide a baseline set of data for comparison against the monitoring efforts during construction. Using the same monitoring methodologies during post-construction, surveys will provide for an assessment of the potential long-term impacts of the Project. Several different methodologies will be employed to assess Project- related impacts, including vessel-based visual surveys.	Pre-Construction, Construction, O&M, Decommissioning	These surveys can be used to assess the potential long-term impacts that the Project may have on turtle populations in the Offshore Wind Area.
14	Level A and Level B harassment zone verification	Revolution Wind will conduct SOUND FIELD VERIFICATION under the following circumstances: • Impact driving of the first three monopiles installed over the duration of the LOA; • If Revolution Wind obtains technical information that indicates a subsequent monopile is likely to produce larger sound fields; and	Construction	These measures can be used to evaluate the potential for level A and B harassment levels to be achieved during impact

<table>
<tr><th>E3PM #</th><th>EPM</th><th>Description</th><th>Project Phase</th><th>Anticipated Effect</th></tr>
<tr><td></td><td></td><td>• At least three monopiles of the same size if a reduction to the clearance and/or SZs is requested.
Revolution Wind will conduct a SOUND FIELD VERIFICATION to empirically determine the distances to the isopleths corresponding to Level A harassment and Level B harassment thresholds, including at the locations corresponding to the modeled distances to the Level A harassment and Level B harassment thresholds, or as agreed to in the SOUND FIELD VERIFICATION Plan. As a secondary method, Revolution Wind may also estimate distances to Level A harassment and Level B harassment thresholds by extrapolating from in situ measurements at multiple distances from the monopile, including at least one measurement location at 750 m from the pile</td><td></td><td>pile driving as accurately as possible and to highlight potential for changes to SZs if necessary.</td></tr>
<tr><td>15</td><td>Modification of shutdown and monitoring zones</td><td>Revolution Wind may request a modification to the size of shutdown and monitoring zones based on the results of pile measurements. The zones will be determined as follows:
• The large whale pre-start CZ will be calculated as the radius of the maximum Level A
• exposure range of any mysticete.
• The right whale pre-start CZ will be equal to the marine mammal Level B zone.
• The large whale, including right whale, SZ will be calculated as the radius of the maximum Level A exposure range of any mysticete.
• The harbor porpoise and seal pre-start CZ and SZ will be determined as the extent of the level A exposure range.
• For all mid-frequency cetaceans other than sperm whales, the pre-start clearance and SZs will effectively be the perimeter of the NMS because the physical placement of the NMS will preclude take (i.e., the Level A zone is smaller than the distance of the NMS from the pile)
In the case of expanded clearance and SZs, zone monitoring will be achieved through a combined effort of passive acoustic monitoring and visual observation. Based on the sound field verification results, the secondary vessel will be placed at the outer limit of the subsequent Large Whale SZ defined in the PSMMP. No additional PSOs or PSO vessels are proposed to visually monitor the expanded zones.</td><td>Construction</td><td>These mitigation measures allow for the SZs to modified to better represent actual risks to marine wildlife from noise generating activities once sufficient evidence is present to permit such a change.</td></tr>
<tr><td>16</td><td>Impact pile driving time of year restriction</td><td>No pile installation will occur from 01 January to 30 April to avoid the times of year when NARW are present in higher densities.</td><td>Construction</td><td>Time-of-year restrictions for impact pile- driving activities would minimize and avoid potential adverse effects to ESA- listed species, specifically NARW, that are more likely to occur in the area during that time period.</td></tr>
<tr><td>17</td><td>Noise attenuation systems (NAS) during impact pile driving</td><td>The Project will use a primary and secondary NAS system for all impact piling events, composed of a combination of two devices (e.g., bubble curtain, hydro-damper) to reduce noise propagation during monopile foundation pile driving. Revolution Wind is committed to achieving a minimum of 10 dB noise attenuation for all impact pile driving activities.</td><td>Construction</td><td>Attenuation of sound pressure levels would reduce the area of underwater noise effects to ESA- listed whales, sea turtles, Atlantic sturgeon, manta ray, and the prey they feed upon during impact pile driving.</td></tr>
<tr><td>18</td><td>Impact pile driving – General monitoring and mitigation protocols for impact pile driving</td><td>There are four primary mitigation and monitoring efforts associated with impact pile driving:
1) Vessel-based visual PSOs and associated visual monitoring tools stationed on the construction and any secondary marine mammal monitoring vessels will monitor at night for marine mammals and other protected species using night-vision goggles with thermal clip-ons and a hand-held spotlight;
2) PAM operators and an associated mitigation PAM array in support of the visual PSOs;
3) Noise attenuation systems(NAS); and
4) Acoustic measurement data collection to verify distances to regulatory or mitigation zones.
There will be a team of six to eight visual and acoustic PSOs on the pile driving vessel, and a team of four to eight visual and acoustic PSOs on any secondary marine mammal monitoring vessel (secondary vessel). PAM operators may be located remotely/onshore. PSO and PAM monitoring personnel and equipment available onboard the construction vessel and the secondary monitoring vessel. Personnel and equipment requirements for this activity are listed below:
<table>
<tr><th rowspan="2">Personnel and Equipment</th><th colspan="2">Standard Daytime</th><th colspan="2">Monitoring for Nighttime and Low Visibility</th></tr>
<tr><th>Number on Construction Vessel</th><th>Number on Secondary Vessel</th><th>Number on Construction Vessel</th><th>Number on Secondary Vessel</th></tr>
</table></td><td>Construction</td><td>This monitoring measure would not minimize the potential for adverse effects but would ensure the effectiveness of the required mitigation and monitoring measures for marine mammals, sea turtles, and ESA-listed fish from impact pile driving.</td></tr>
</table>

E3PM #	EPM	Description					Project Phase	Anticipated Effect
		Reticle binoculars	2	2	0	0		
		Visual PSOs on watch	2	2	2	2		
		PAM operators on duty[1]	1	1	1	1		
		Mounted thermal/IR camera system[1]	1	1	1	1		
		Mounted “big-eye” binocular	1	1	0	0		
		Monitoring station for real time PAM system[2]	1	1	1	1		
		Hand-held or wearable NVDs	0	0	2	2		
		IR spotlights	0	0	2	2		
		Data collection software system	1	1	1	1		
		PSO-dedicated VHF radios	2	2	2	2		
		Digital single-lens reflex camera equipped with 300-mm lens	1	1	0	0		
19	Impact pile driving – Daytime visual monitoring, normal visibility	• During the pre-start clearance period, throughout pile driving, and 30-minutes after piling is completed, two PSOs will maintain watch at all times on the construction vessel; likewise, two PSOs will also maintain watch during the same time periods from the secondary vessel. • The total number of observers will be dictated by the personnel necessary to adhere to standard shift schedule and rest requirements while still meeting mitigation monitoring requirements for the Project. • It is expected the full complement of PSOs will not always be required (i.e., full coverage will be in place during piling activities, however, in between piling events, the PSO team can consist of only one PSO on duty). Piling is anticipated to take approximately 1-4 hours (12 hours maximum) per piling event (i.e., 4 hours at a given foundation location) after which the construction vessel moves away to a new location for the next piling event. • During daytime observations, two PSOs on each vessel will monitor the CZ and SZ with the naked eye and reticle binoculars. One PSO will periodically scan outside the SZ using the mounted big eye binoculars. • PSOs will visually monitor, the maximum Level A zone which constitutes the pre-start CZ . This zone encompasses the maximum Level A exposure ranges for all marine mammal species. • The secondary vessel will be positioned and circling at the outer limit of the Large Whale SZ. • PSOs stationed on the secondary vessel will ensure the outer portion of the SZs and prestart CZ are visually monitored. • There will be a PAM operator on duty (see Section 6.2.3) conducting acoustic monitoring in coordination with the visual PSOs during all pre-start clearance periods, piling, and postpiling monitoring periods. • Acoustic monitoring, as described in Section 6.2.3, will extend beyond the Large Whale Pre-Start CZ. • The NARW pre-start CZ will be monitored visually out to the extent of the Large Whale SZ and acoustically out to the extent of the Level B zone.					Construction	This monitoring measure would not minimize the potential for adverse effects but would ensure the effectiveness of the required mitigation and monitoring measures for marine mammals, sea turtles, and ESA-listed fish from impact pile driving.
20	Impact pile driving – Daytime visual monitoring, reduced visibility	• If the monitoring zone is obscured, the two PSOs on watch on each vessel will continue to monitor the SZ utilizing thermal camera systems and PAM. • During nighttime or other low visibility conditions, two PSO on each vessel will monitor the SZ with the mounted EO/IR camera and available handheld night vision as able. • All on-duty PSOs will be in contact with the PAM operator on-duty who will monitor the PAM systems for acoustic detections of marine mammals that are vocalizing in the area.					Construction	This monitoring measure would not minimize the potential for adverse effects but would ensure the effectiveness of the required mitigation and monitoring measures for marine mammals, sea turtles, and ESA-listed fish from impact pile driving.
21	Impact pile driving – Nighttime visual monitoring	Revolution Wind has conducted a test project demonstrating the effectiveness of proposed PAM, EO/IR, and NVD equipment and methods for nighttime monitoring of clearance and shutdown zones (ThayerMayhan 2023). Revolution Wind presented a summary of methods and findings from this study to BOEM and NMFS in an online webinar on March 16, 2023. Revolution Wind is preparing a nighttime monitoring plan detailing proposed personnel, equipment, and protocols and will submit this plan for review and approval by BOEM and NMFS no later than 90 days prior to initiating project construction. These protocols and methods include, but are not limited to:					Construction	This monitoring measure would not minimize the potential for adverse effects but would ensure the effectiveness of the required mitigation and monitoring measures for marine

<table>
<tr><th>E3PM #</th><th>EPM</th><th>Description</th><th>Project Phase</th><th>Anticipated Effect</th></tr>
<tr><td></td><td></td><td>• During nighttime operations, visual PSOs on-watch will rotate in pairs: one observing with an NVD and one monitoring the IR thermal imaging camera system. There will also be a PAM operator on duty (see next section) conducting acoustic monitoring in coordination with the visual PSOs.
• The mounted thermal cameras may have automated detection systems or require manual monitoring by a PSO.
• PSOs will focus their observation effort during nighttime watch periods within the SZs and waters immediately adjacent to the vessel.
• If possible, deck lights will be extinguished or dimmed during night observations when using the NVDs (strong lights compromise the NVD detection abilities); alternatively, if the deck lights must remain on for safety reasons, the PSO will attempt to use the NVDs in areas away from potential interference by these lights.</td><td></td><td>mammals, sea turtles, and ESA-listed fish from impact pile driving.</td></tr>
<tr><td>22</td><td>Impact pile driving – PAM</td><td>PAM systems will be used to supplement visual monitoring during reduced visibility and nighttime conditions.
• PAM should begin at least 30-minutes prior to the start of piling.
• One PAM operator on duty during both daytime and nighttime/low visibility monitoring.
• Since visual observations within the applicable SZs can become impaired at night or during daylight hours due to fog, rain, or high sea states, visual monitoring with thermal and NVDs will be supplemented by PAM during these periods.
• PAM operator will monitor during all pre-start clearance periods, piling, and post-piling monitoring periods (daylight, reduced visibility, and nighttime monitoring).
• Real-time PAM systems require at least one PAM operator to monitor each system by viewing data or data products that are streamed in real-time or near real-time to a computer workstation and monitor located on a Project vessel or onshore.
• PSOs will acoustically monitor designated monitoring zones for all marine mammals, as well as the NARW specific CZ .
• It is expected there will be a PAM operator stationed on at least one of the dedicated monitoring vessels in addition to the PSOs; or located remotely/onshore.
• PAM operators will complete specialized training for operating PAM systems prior to the start of monitoring activities.
• All on-duty PSOs will be in contact with the PAM operator on-duty, who will monitor the PAM systems for acoustic detections of marine mammals that are vocalizing in the area.
• The PAM operator will inform the Lead PSO on duty of animal detections approaching or within applicable ranges of interest to the pile-driving activity via the data collection software system (i.e., Mysticetus or similar system) who will be responsible for requesting the designated crewmember to implement the necessary mitigation procedures.
• Acoustic monitoring during nighttime and low visibility conditions during the day will complement visual monitoring (e.g., PSOs and thermal cameras) and will cover an area of at least the PAM CZ .</td><td>Construction</td><td>This monitoring measure would not minimize the potential for adverse effects but would ensure the effectiveness of the required mitigation and monitoring measures for marine mammals, sea turtles, and ESA-listed fish from impact pile driving.</td></tr>
<tr><td>23</td><td>Impact pile driving – General mitigation measures</td><td>Mitigation measures implemented during a piling event include:
• Pre-start clearance;
• Soft start of the pile strikes;
• Post-piling monitoring;
• Shutdowns, and
• Monitoring during unforeseen pauses in piling
Summary of mitigation measures during WTG impact pile driving with a noise attenuation system in Summer (May through November).
<table>
<tr><th>Measure</th><th>NARW</th><th>Other LFC</th><th>Sperm Whale</th><th>Sea Turtles</th></tr>
<tr><td>Monitoring zone – WTG installation</td><td>10,000 m (PAM)</td><td>10,000 m (PAM)</td><td>10,000 m (PAM)</td><td>>3,900 m</td></tr>
<tr><td>Monitoring zone – OSS installation</td><td>10,000 m (PAM)</td><td>10,000 m (PAM)</td><td>10,000 m (PAM)</td><td>>4,100 m</td></tr>
<tr><td>Pre-start clearance and shutdown zone – WTG installation</td><td>Visual - Any distance PAM clearance/ shutdown – 3,900 m</td><td>3,900 m</td><td>2,300 m</td><td>500 m</td></tr>
<tr><td>Pre-start clearance and shutdown zone – OSS installation</td><td>Visual - Any distance PAM clearance/ shutdown – 4,100 m</td><td>1,600 m</td><td>1,600 m</td><td>500 m</td></tr>
</table></td><td>Construction</td><td>This monitoring measure would not minimize the potential for adverse effects but would ensure the effectiveness of the required mitigation and monitoring measures for marine mammals, sea turtles, and ESA-listed fish from impact pile driving.</td></tr>
</table>

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<tr><th>E3PM #</th><th>EPM</th><th>Description</th><th>Project Phase</th><th>Anticipated Effect</th></tr>
<tr><td></td><td></td><td>
<table>
<tr><td>Clearance duration</td><td>60 min visual monitoring, 60 min PAM monitoring; zone must be clear for 30 min</td></tr>
<tr><td>Soft start</td><td>All piles</td></tr>
<tr><td>Post-piling monitoring</td><td>30 minutes</td></tr>
</table>

Summary of mitigation measures during WTG impact pile driving with a noise attenuation system in Winter (December only).
<table>
<tr><th>Measure</th><th>NARW</th><th>Other LFC</th><th>Sperm Whale</th><th>Sea Turtles</th></tr>
<tr><td>Monitoring zone – WTG installation</td><td>10,000 m (PAM)</td><td>10,000 m (PAM)</td><td>10,000 m (PAM)</td><td>n/a</td></tr>
<tr><td>Monitoring zone – OSS installation</td><td>10,000 m (PAM)</td><td>10,000 m (PAM)</td><td>10,000 m (PAM)</td><td>n/a</td></tr>
<tr><td>Pre-start clearance and shutdown zone – WTG installation</td><td>Visual - Any distance PAM clearance/ shutdown – 4,400 m</td><td>4,400 m</td><td>4,400</td><td>n/a</td></tr>
<tr><td>Pre-start clearance and shutdown zone – OSS installation</td><td>Visual - Any distance PAM clearance/ shutdown – 4,700 m</td><td>2,700 m</td><td>2,700 m</td><td>n/a</td></tr>
</table>
<table>
<tr><td>Clearance duration</td><td>60 min visual monitoring, 60 min PAM monitoring; zone must be clear for 30 min</td></tr>
<tr><td>Soft start</td><td>All piles</td></tr>
<tr><td>Post-piling monitoring</td><td>30 minutes</td></tr>
</table>
</td><td></td><td></td></tr>
<tr><td>24</td><td>Impact pile driving - Pre-start clearance measures</td><td>A 60-minute pre-start clearance period will be implemented for impact pile driving activities. Visual PSOs will begin surveying the monitoring zone at least 60 minutes prior to the start of pile driving. PAM monitoring will also begin at least 30-minutes prior to the start of piling.
The large whale CZ (2,300 m or as modified) must be fully visible for at least 30 minutes prior to commencing ramp-up.
All marine mammals must be confirmed to be out of the CZ prior to initiating soft start.
If a marine mammal is observed entering or within the relevant CZs prior to the initiation of pile driving activity, pile driving activity will be delayed.
An acoustic detection localized to a position within the CZ will trigger a delay.
A NARW sighted at any distance will trigger a delay.
Impact pile driving may commence when either the marine mammal(s) has voluntarily left the respective CZ and been visually confirmed beyond that CZ, or, when 30 minutes have elapsed without re-detection for whales, including NARW; or 15 minutes have elapsed without re-detection of dolphins, porpoises, and seals.</td><td>Construction</td><td>This monitoring measure would minimize the potential for adverse effects on marine mammals, sea turtles, and ESA-listed fish from impact pile driving.</td></tr>
<tr><td>25</td><td>Impact pile driving - Soft start measures</td><td>Every monopile installation will begin with a soft start procedure of a minimum of 20-minute duration.
Soft start of pile driving will not begin until the CZ has been cleared by the visual PSO (and PAM operators when applicable).
If any marine mammals are detected within the applicable CZ prior to or during the soft start, activities will be delayed until the animal has been observed exiting the CZ or until an additional time period has elapsed with no further sighting.
Generic soft start measures as follows:
Percent of maximum impact hammer blow energy: 10 to 20%.
Monopile blow energy: 600-800 kJ.
Strike rate: 4-6 strikes/min.
Duration: Minimum of 20 minutes or greater until vertical pile stability is secured.</td><td>Construction</td><td>This monitoring measure would minimize the potential for adverse effects on marine mammals, sea turtles, and ESA-listed fish from impact pile driving.</td></tr>
<tr><td>26</td><td>Impact pile driving - Post-activity monitoring</td><td>PSOs will continue to survey the monitoring zone using visual and acoustic protocols throughout the pile installation and for a minimum of 30 minutes after piling has been completed.</td><td></td><td>This monitoring measure would not minimize the potential for adverse effects but would ensure the effectiveness of the required mitigation and</td></tr>
</table>

E3PM #	EPM	Description	Project Phase	Anticipated Effect
				monitoring measures for marine mammals, sea turtles, and ESA-listed fish from impact pile driving.
27	Impact pile driving – Shutdown protocols	Impact pile driving procedures follow three general criteria: 1) The piling schedule (and therefore resulting sound field) does not exceed the maximum scenario modelled for regulatory authorizations. 2) Refusal criteria is not exceeded. Refusal criteria is defined as: (i) 125 blows/25 centimeters (cm) over an increment of 6 × 25 cm (ii) 200 blows/25 cm over an increment of 2 × 25 cm (iii) 325 blows/25 cm over an increment of 1 × 25 cm. 3) The hammer drives the pile to target penetration. If a marine mammal is entering or within the respective SZs (or a NARW sighted at any distance) after pile driving has commenced, an immediate shutdown of pile driving will be implemented unless Revolution Wind and/or its contractor determines shutdown is not feasible. After a shutdown, pile driving must only be initiated once all SZs are confirmed by PSOs to be clear of marine mammals and sea turtles for the minimum species-specific time periods. After a shutdown is implemented: • The SZ and CZ will be continuously monitored by PSOs and PAM during any pauses in pile driving. • If marine mammals or sea turtles are sighted within a SZ during a pause in piling, resumption of pile driving will be delayed until the animal(s) has moved outside the shutdown or when 30 minutes have elapsed without redetection for whales, including the NARW, or 15 minutes have elapsed without redetection of sea turtles. Shutdown procedures will be superseded only when they present an imminent risk of injury or loss of life to an individual; or risk of damage to a vessel that creates risk of injury or loss of life for individuals. There are two imminent risk scenarios that could defer a pile shutdown, pile refusal and pile instability. If either of these scenarios prevent shutdown, the hammer will operate at reduced energy to minimize impacts to protected species while maintaining safety.	Construction	This monitoring measure would avoid unacceptable risks to property and safety while minimizing adverse effects on marine mammals, sea turtles, and ESA-listed fish from impact pile driving.
28	Impact pile driving - Sound field verification	• All measurements will be performed according to the ISO 18406:2017 standard. • The foundation installation noise will be measured using omnidirectional hydrophones capable of measuring frequencies between 20 Hz and 20 kHz. • The hydrophone signals will be verified before deployment and after recovery by means of a pistonphone calibrator on deck or similar method. • Seven measurement positions will be established around each WTG and OSS foundation, four positioned equidistant at a 750 m radius, and one position at 1,500, 3,000, and 6,000 m. • Each measurement position will consist of two hydrophones at approximately mid-depth and 2 meters above the seafloor. Deployment will be made using a heavy weight as anchor - to prevent equipment drifting (typically total ballast weight exceeding 100 kg). • Deployment and retrieval position of each hydrophone will be recorded using hand-held GPS equipment, or alternative precise method. The hydrophones will be placed at various distances from the installation location. • The equipment, methodology, placement, and analysis will be the same for all pile measurements. Output results will include sound pressure level and frequency context. Measurements will be conducted in a detailed configuration at the beginning of installation.	Construction	This mitigation measure ensures that noise level data collected during sound field verification is consistently collected at the highest possible standard using up to date methodology. In turn this allows for implemented mitigation to be optimally effective.
29	Impact pile driving - Recording	• All data recording will be conducted using Mysticetus or similar software. • Operations, monitoring conditions, observation effort, all marine mammal detections, and any mitigation actions will be recorded. • Members of the monitoring team must consult NMFS' NARW reporting systems for the presence of NARWs in the Project area. • DMAs will be reported across all Project vessels. • See additional details regarding reporting is provided below under "Reporting"	Construction	This monitoring measure would ensure monitoring of mitigation effectiveness and compliance. The data gathered could be used to evaluate impacts and potentially lead to additional mitigation measures, if required.
30	Vibratory pile driving	Visual monitoring protocols will be in place for all vibratory sheet pile installation and removal. All observations will take place from one of the construction vessels stationed at or near the sheet piling location. PAM is not proposed because it is likely to be ineffective due to masking effects. Personnel and equipment used for vibratory pile driving are as follows:	Construction	This monitoring measure would not minimize the potential for adverse effects but would ensure the effectiveness of the

<table>
<tr><th>E3PM #</th><th>EPM</th><th>Description</th><th>Project Phase</th><th>Anticipated Effect</th></tr>
<tr><td></td><td></td><td><table><tr><th>Personnel and Equipment</th><th># on Construction Vessel</th></tr><tr><td>PSOs on watch</td><td>2</td></tr><tr><td>Reticle binoculars</td><td>2</td></tr><tr><td>Mounted thermal/IR camera system</td><td>1</td></tr><tr><td>Mounted “big-eye” binocular</td><td>1</td></tr><tr><td>Hand-held or wearable NVDs</td><td>2</td></tr><tr><td>IR spotlights</td><td>2</td></tr><tr><td>Data collection software system</td><td>1</td></tr><tr><td>PSO-dedicated VHF radios</td><td>2</td></tr><tr><td>Digital single-lens reflex camera equipped with 300-mm lens</td><td>1</td></tr></table></td><td></td><td>required mitigation and monitoring measures for marine mammals, sea turtles, and ESA-listed fish from impact pile driving.</td></tr>
<tr><td>31</td><td>Vibratory pile driving – Daytime visual monitoring, normal visibility</td><td>Visual monitoring will occur from the construction vessel to provide complete visual coverage of clearance and SZs during vibratory sheet pile installation and removal.
Two PSOs will maintain watch on the construction vessel during the pre-start clearance period throughout vibratory pile installation and removal, and 30-minutes after piling is completed.
Two PSOs will conduct observations concurrently. The total number of observers will be dictated by the personnel necessary to adhere to standard schedule and rest requirements while meeting Project mitigation monitoring requirements.
PSOs will visually monitor the CZ and SZs.
One observer will monitor the CZ and SZs with the naked eye and reticle binoculars. One PSO will monitor in the same way but will periodically scan outside the SZ using the mounted big eye binoculars.</td><td>Construction</td><td>Same as above</td></tr>
<tr><td>32</td><td>Vibratory pile driving – Daytime visual monitoring, reduced visibility</td><td>During daytime low visibility conditions, one PSO will monitor the CZ and SZs with the mounted IR camera while the other maintains visual watch with the naked eye / binoculars.</td><td>Construction</td><td>Same as above</td></tr>
<tr><td>33</td><td>Vibratory pile driving – Nighttime visual monitoring</td><td>Landfall construction activities, including vibratory pile driving, will not take place at night. Construction activities are prohibited between 6 p.m. and 7 a.m. by local noise ordinance (North Kingstown, RI Ord. No. 83-3(a)).</td><td>n/a</td><td>n/a</td></tr>
<tr><td>34</td><td>Vibratory pile driving – Monitoring, clearance, and shutdown zones</td><td><table><tr><th>Measure</th><th>NARW</th><th>Other Large Whales</th><th>Sea Turtles</th></tr><tr><td>Pre-start clearance zone</td><td>100 m</td><td>100 m</td><td>50 m</td></tr><tr><td>Shutdown zone</td><td>100 m</td><td>100 m</td><td>50 m</td></tr><tr><td>Clearance duration</td><td colspan="3">30 min visual monitoring; zone must be clear for 30 min</td></tr><tr><td>Post-piling monitoring</td><td colspan="3">30 minutes</td></tr></table></td><td>Construction</td><td>This monitoring measure would not minimize the potential for adverse effects but would ensure the effectiveness of the required mitigation and monitoring measures for marine mammals, sea turtles, and ESA-listed fish from impact pile driving.</td></tr>
<tr><td>35</td><td>Vibratory pile driving – Pre-start clearance and operational monitoring</td><td>PSOs will monitoring the CZ for 30 minutes prior to start of vibratory pile driving.
If a protected species is observed entering or within the CZ piling cannot commence until the animal has exited the CZ or time has elapsed since the last sighting (30 minutes for large whales, 15 minutes for sea turtles and small odontocetes).
PSOs will continue to survey SZs using visual protocols throughout the vibratory pile driving and for a minimum of 30 minutes after piling has been completed.</td><td>Construction</td><td>Same as above</td></tr>
<tr><td>36</td><td>Vibratory pile driving – Shutdown protocol</td><td>If a protected species is observed entering or within the respective SZs after sheet pile installation has commenced, a shutdown will be implemented as long as health and safety is not compromised.
SZs must be continuously monitored by PSOs during any pauses in vibratory pile driving.
If protected species are sighted within a respective SZ during a pause in vibratory pile driving, activities will be delayed until the animal(s) has moved outside the SZ or when 30 minutes have elapsed without redetection for large whales, including the NARW, or 15 minutes have elapsed without redetection of sea turtles or small odontocetes.</td><td>Construction</td><td>Same as above</td></tr>
</table>

<table>
<tr><th>E3PM #</th><th>EPM</th><th>Description</th><th>Project Phase</th><th>Anticipated Effect</th></tr>
<tr><td>37</td><td>Vibratory pile driving – Sound source verification</td><td>• Received sound measurements will be collected during vibratory pile driving at the landfall construction site. The measurement plan will be similar to that described for impact pile driving in EPM #28, which is designed to collect data on approximate source levels, the directionality of the sounds produced, and transmission loss in at least one direction.
• The number and location of recorders may be reduced to measurements conducted in open water locations due to the presence of nearby land.
• The distances at which acoustic recorders are placed from the landfall construction will be determined based on the modeled distances to the acoustic thresholds for vibratory pile driving.
• The goals of the field verification measurements include verification of modeled ranges to the harassment threshold isopleths and providing sound measurements of vibratory pile driving using ISO (2017) standard methods for comparison among projects and informing future operations.</td><td>Construction</td><td>Same as above</td></tr>
<tr><td>38</td><td>HRG surveys – Visual observation protocols and methods</td><td>The following visual observation protocols will be implemented by all PSOs employed on Project vessels:
• Visual monitoring of the established clearance, shutdown, and monitoring zone will be performed by PSO teams on each survey vessel.
• Observations will take place from the highest available vantage point on all the survey vessels. General 360° scanning will occur during the monitoring periods, and target scanning by the PSO will occur if cued to a marine mammal. PSOs will adjust their positions appropriately to ensure adequate coverage of the entire shutdown and monitoring zones around the respective sound sources.
• PSOs will work in shifts such that no one PSO will work more than 4 consecutive hours without a 2-hour break or longer than 12 hours during any 24-hour period.
• The PSOs will begin observation of the CZs prior to initiation of HRG survey operations and will continue observation of the SZs throughout the survey activity and for 30 minutes following cessation of the survey activity using equipment operating below 180 kHz.
• The PSOs will be responsible for visually monitoring and identifying marine mammals approaching or entering the established zones during survey activities.
• It will be the responsibility of the PSO(s) on duty to communicate the presence of marine mammals as well as to communicate the recommended mitigation action(s) that are necessary to ensure mitigation and monitoring requirements are implemented as appropriate.</td><td>Construction and O&M</td><td>This monitoring measure would not minimize the potential for adverse effects but would ensure the effectiveness of the required mitigation and monitoring measures for marine mammals, sea turtles, and ESA-listed fish from impact pile driving.</td></tr>
<tr><td>39</td><td>HRG surveys – Monitoring, clearance and shutdown zones</td><td><table><tr><th>Measure</th><th>NARW</th><th>Other LFCs</th><th>Sperm Whales</th><th>Sea Turtles</th><th></th></tr><tr><td>Pre-start clearance zone</td><td>500 m</td><td colspan="2">100 m</td><td>100 m</td><td>100 m</td></tr><tr><td>Shutdown zone</td><td>500 m</td><td colspan="2">100 m</td><td>100 m</td><td>100 m</td></tr></table></td><td>Construction and O&M</td><td>Same as above</td></tr>
<tr><td>40</td><td>HRG surveys – Daytime visual protocols</td><td>The following protocols will be applied to visual monitoring during daytime surveys:
• One PSO on watch during pre-clearance periods and all source operations.
• PSOs will use reticle binoculars and naked eye to scan the monitoring zone for protected species.</td><td>Construction and O&M</td><td>Same as above</td></tr>
<tr><td>41</td><td>HRG surveys – Nighttime and low visibility visual protocols</td><td>Visual monitoring during nighttime surveys or periods of low visibility will utilize the following protocols:
• The lead PSO will determine if conditions warrant implementing reduced visibility protocols.
• Two PSOs on watch during pre-clearance periods, all operations, and for 30 minutes following use of HRG sources operating below 180 kHz
• Each PSO should use the most appropriate available technology (e.g., IR camera and NVD) and viewing locations to monitor the clearance and SZs and maintain vessel separation distances.</td><td>Construction and O&M</td><td>Same as above</td></tr>
<tr><td>42</td><td>HRG surveys – Autonomous surface vehicle</td><td>Should an autonomous surface vessel (ASV) be utilized during surveys, the following procedures will be implemented:
• PSOs will be stationed aboard the mother vessel to monitor the ASV in a location which will offer a clear, unobstructed view of the ASV's shutdown and monitoring zones.
• When in use, the ASV will be within 800 m (2,625 ft) of the primary vessel while conducting survey operations.
• For monitoring around an ASV, if utilized, a dual thermal/high definition camera will be installed on the mother vessel facing forward and angled in a direction so as to provide a field of view ahead of the vessel and around the ASV.
• PSOs will be able to monitor the real-time output of the camera on hand-held iPads or tables. Images from the cameras can be captured for review and to assist it verifying species identification.
• A monitor will also be installed on the bridge displaying the real-time picture from the thermal/HD camera installed on the front of the ASV itself, providing an additional forward field of view of the craft.
• Night-vision goggles with thermal clip-ons, as mentioned above, and a hand-held spotlight will be provided such that PSOs can focus observations in any direction around the mother vessel and/or the ASV.</td><td>Construction and O&M</td><td>Same as above</td></tr>
</table>

E3PM #	EPM	Description	Project Phase	Anticipated Effect
43	HRG surveys – Pre-start clearance	• PSOs will implement a 30-minute clearance period of the CZ immediately prior to the initiation of equipment ramp-up. • The CZ must be visible using the naked eye or appropriate visual technology during the entire clearance period for operations to start. If the CZ are not visible, source operations <180 kHz may not commence. • Ramp-up may not be initiated if any protected species is detected within its respective CZ. • If a protected species is observed within its respective CZ during the pre-start clearance • period, ramp-up may not begin until the animal(s) has been observed exiting its respective • CZ or until an additional time period has elapsed with no further sighting (i.e., 15 minutes for sea turtles and 30 minutes for all other species).	Construction and O&M	Same as above
44	HRG surveys – Ramp up	• Where technically feasible, a ramp-up procedure will be used for HRG survey equipment capable of adjusting energy levels at the start or re-start of HRG survey activities. Ramp-up procedures provide additional protection to marine mammals near the Project Area by allowing them to vacate the area prior to the commencement of survey equipment use at full power. • The ramp-up procedure will not be initiated during periods of inclement conditions or if the CZs cannot be adequately monitored by the PSOs, using the appropriate visual technology for a 30-minute period immediately prior to ramp up. • Ramp-up will begin with the power of the smallest acoustic equipment at its lowest practical power output. When technically feasible the power will then be gradually turned up and other acoustic sources added in a way such that the source level would increase gradually. • Ramp-up activities will be delayed if a protected species enters its respective CZ. Ramp up will continue if the animal has been observed exiting its respective CZ or until an additional time period has elapsed with no further sighting (i.e., 15 minutes for sea turtles and 30 minutes for all other species).	Construction and O&M	Same as above
45	HRG surveys – Operations monitoring	• PSOs will monitor Mysticetus (or similar data system) and/or appropriate data systems for DMAs established within their survey area. • PSOs will also monitor the NMFS NARW reporting systems including Whale Alert and RWSAS once every PSO shift during Project-related activities within, or adjacent to, SMAs and/or DMAs.	Construction and O&M	Same as above
46	HRG surveys – Shutdown protocols	• Shutdown of impulsive, non-parametric HRG survey equipment other than CHRIP sub-bottom profilers operating at frequencies <200 kHz is required if a marine mammal is sighted at or within its respective shutdown zone. • The vessel operator must comply immediately with any call for shutdown by the Lead PSO. Any disagreement between the Lead PSO and vessel operator should be discussed only after shutdown has occurred. • Subsequent restart of the survey equipment will not be initiated until either the marine mammal(s) that triggered the shutdown has voluntarily left and been visually confirmed beyond the relevant CZ, or when 30 minutes have elapsed without re-detection (for marine mammals) or 15 minutes have elapsed without re-detection (for sea turtles). • If the acoustic source is shut down for reasons other than mitigation (e.g., mechanical difficulty) for less than 30 minutes, it may be activated again without ramp-up if PSOs have maintained constant observation and no detections of any marine mammal have occurred within the respective SZs. • If the acoustic source is shut down for a period longer than 30 minutes or PSOs were unable to maintain constant observation, then pre-start clearance and ramp-up procedures will be initiated.	Construction and O&M	Same as above
47	UXO detonation – General protocols	There are six primary mitigation and monitoring efforts associated with UXO detonation: 1) Pre-start clearance; a. Vessel-based visual PSOs and associated visual monitoring tools stationed on the primary monitoring vessel and on any additional marine mammal monitoring vessels (when monitoring zones with radii greater than 2,000 m may require an additional monitoring vessel); b. Alternate Plan for CZ >5 km associated with unmitigated detonation: Aerial based visual observers conducting pre-start surveys of the CZ. 2) PAM operators and an associated mitigation PAM array in support of the visual PSOs; 3) NMSs as feasible; 4) Post-detonation monitoring; 5) Acoustic measurement data collection to verify distances to regulatory or mitigation zones, and; 6) Monitoring and mitigation protocols applicable to UXO detonation, as described below. There will be a team of 6 - 8 visual and acoustic PSOs on monitoring vessels. The number of vessels will depend on the size of the zones to be monitored. A single vessel is anticipated to adequately cover a radius of 2,000 m. There will be a team of four to eight visual and acoustic PSOs on each monitoring vessel. The number of vessels will be sufficient to observe the maximum CZ 100% of the time and be determined by:	Construction	This monitoring measure would not minimize the potential for adverse effects but would ensure the effectiveness of the required mitigation and monitoring measures for marine mammals, sea turtles, and ESA-listed fish from impact pile driving.

<table>
<tr><th>E3PM #</th><th>EPM</th><th>Description</th><th>Project Phase</th><th>Anticipated Effect</th></tr>
<tr><td></td><td></td><td>• the detonation category and associated CZ size,
• use of NMS (as feasible), and
• minimum distance allowed to the detonation location.
PAM operators may be located remotely/onshore.</td><td></td><td></td></tr>
<tr><td>48</td><td>UXO detonation – Personnel requirements</td><td>Personnel and equipment for marine monitoring vessels used for UXO detonation are as follows.
<table>
<tr><th>Personnel and Equipment</th><th># on Construction Vessel</th></tr>
<tr><td>Visual PSOs on watch</td><td>2</td></tr>
<tr><td>PAM operators on duty</td><td>1</td></tr>
<tr><td>Reticle binoculars</td><td>2</td></tr>
<tr><td>Monitoring station for real time PAM system</td><td>1</td></tr>
<tr><td>Data collection software system</td><td>1</td></tr>
<tr><td>PSO-dedicated VHF radios</td><td>2</td></tr>
<tr><td>Digital single-lens reflex camera equipped with 300-mm lens</td><td>1</td></tr>
</table></td><td>Construction</td><td>Same as above</td></tr>
<tr><td>49</td><td>UXO detonation - Monitoring and clearance zones</td><td>Mitigation and monitoring zones for UXO detonation based on device size by protected species hearing group:
<table>
<tr><th rowspan="2">Hearing Group</th><th colspan="5">Pre-start Clearance Zone by UXO Device Size</th></tr>
<tr><th>E4 (2.3 kg)</th><th>E6 (9.1 kg)</th><th>E8 (45.5 kg)</th><th>E10 (227 kg)</th><th>E12 (454 KG)</th></tr>
<tr><td>Low frequency cetaceans</td><td>RWEC: 600 m
Lease Area: 400 m</td><td>RWEC: 1,000 m
Lease Area: 800 m</td><td>RWEC: 1,800 m
Lease Area: 1,600 m</td><td>RWEC: 3,000 m
Lease Area: 3,000 m</td><td>RWEC: 3,800 m
Lease Area: 3,700 m</td></tr>
<tr><td>Mid frequency cetaceans</td><td>RWEC: 50 m
Lease Area: 50 m</td><td>RWEC: 80 m
Lease Area: 50 m</td><td>RWEC: 200 m
Lease Area: 100 m</td><td>RWEC: 400 m
Lease Area:400 m</td><td>RWEC: 500 m
Lease Area: 500 m</td></tr>
<tr><td>Sea turtles</td><td>RWEC: 50 m
Lease Area: 50 m</td><td>RWEC: 80 m
Lease Area: 50 m</td><td>RWEC: 200 m
Lease Area: 100 m</td><td>RWEC: 400 m
Lease Area:400 m</td><td>RWEC: 500 m
Lease Area: 500 m</td></tr>
</table></td><td>Construction</td><td>Same as above</td></tr>
<tr><td>50</td><td>UXO detonation – Visual monitoring, vessel-based</td><td>Visual monitoring will be conducted from the primary monitoring vessel, and additional vessels in cases where the mitigation zone cannot be covered by a single vessel. Daytime visual monitoring is defined by the period between civil nautical twilight rise and set for the region. No nighttime UXO detonation will be conducted. Daytime monitoring protocols are as follows:
• During the pre-start clearance period and 60-minutes after the detonation event, two PSOs will maintain watch at all times on the primary vessel; likewise, two PSOs will also maintain watch during the same time periods from the additional vessel. During the pre-start clearance period and 60-minutes after the detonation event, two PSOs will maintain watch at all times on the primary vessel; likewise, two PSOs will also maintain watch during the same time periods from the additional vessel.
• The total number of observers will be dictated by the personnel necessary to adhere to standard shift schedule and rest requirements while still meeting mitigation monitoring requirements for the Project.
• During daytime observations, two PSOs on each vessel will monitor the CZs with the naked eye and reticle binoculars. One PSO will periodically scan outside the CZs using the mounted big eye binoculars.
• PSOs will visually monitor the maximum Low Frequency (Large Whale) Level A zone which constitutes the pre-start CZ. This zone encompasses the maximum Level A exposure ranges for all marine mammal species except harbor porpoise, where Level A take has been requested due to the large zone sizes associated with High Frequency cetaceans.
• The number of vessels deployed will depend on monitoring zone size and safety set back distance from detonation. A sufficient number of vessels will be deployed to provide 100% temporal and spatial coverage of the CZs.
• There will be a PAM operator on duty (see Section 6.2.3) conducting acoustic monitoring in coordination with the visual PSOs during all pre-start clearance periods and post-detonation monitoring periods.</td><td>Construction</td><td>Same as above</td></tr>
</table>

E3PM #	EPM	Description	Project Phase	Anticipated Effect
		• Acoustic monitoring will include, and extend beyond, the Large Whale pre-start CZ.		
51	UXO detonation – Visual monitoring, aerial alternative	Aerial monitoring may be used under specific circumstances, e.g., the discovery of large UXOs having clearance areas that cannot be monitored effectively from a surface vessel. Aerial monitoring will be used to provide complete visual coverage of clearance areas under these circumstances, using the following protocols: During the pre-start clearance period and 60-minutes after the detonation event as flight time allows, two PSOs will be deployed on an aerial platform. Surveys will be conducted in a grid with 1 km line spacing, encompassing the CZ. • PSOs will monitor the CZs with the naked eye and reticle binoculars. • Aerial PSOs may exceed 4-hour watch duration but will be limited by total flight duration not likely to exceed 6 hours. • PSOs will visually monitor the maximum Low-Frequency (Large Whale) Level A zone which constitutes the pre-start CZ. This zone encompasses the maximum Level A exposure ranges for all ESA-listed marine mammals. • There will be a PAM operator on duty conducting acoustic monitoring in coordination with the visual PSOs during all pre-start clearance periods and post-detonation monitoring periods. • Acoustic monitoring will include, and extend beyond, the Large Whale Pre-Start CZ.	Construction	Same as above
52	UXO detonation – Passive acoustic monitoring	Acoustic monitoring will be conducted prior to any UXO detonation event in addition to visual monitoring in order to ensure that no marine mammals are present in the designated pre-start CZs. PAM operators will acoustically monitor a zone that encompasses a minimum of 10 km radius around the source. PAM will be conducted in the daylight only as no UXO will be detonated during nighttime hours. PAM devices proposed for monitoring during UXO detonation activities are not likely to be towed from the vessel, but rather will be independent (e.g., autonomous or moored remote) stations located around the area to be monitored. The specific placement of PAM devices or systems will be determined based on the final mitigation zones determined in the regulatory review process. The following PAM protocols will be followed for UXO detonation events: • A PAM operator will be stationed on at least one of the dedicated monitoring vessels in addition to the PSOs; or located remotely/onshore. • PAM operators will complete specialized training for operating PAM systems prior to the start of monitoring activities. • All on-duty PSOs will be in contact with the PAM operator on-duty, who will monitor the PAM systems for acoustic detections of marine mammals that are vocalizing in the area. • For real-time PAM systems, at least one PAM operator will be designated to monitor each system by viewing data or data products that are streamed in real-time or near real-time to a computer workstation and monitor located on a Project vessel or onshore. No archival recording systems will be used. • The PAM operator will inform the Lead PSO on duty of animal detections approaching or within applicable ranges of interest to the detonation activity via the data collection software system (i.e., Mysticetus or similar system). The Lead PSO will be responsible for requesting the designated crewmember to implement a delay in UXO detonation.	Construction	Same as above
53	UXO detonation – Pre-start clearance	A 60-min pre-start clearance period will be implemented prior to any UXO detonation. Visual PSOs will begin surveying the monitoring zone at least 60 min prior to the detonation event. PAM will also begin 60 min prior to the detonation event. • The Large Whale CZ must be fully visible for at least 60 min immediately prior to commencing detonation. • All marine mammals must be confirmed to be out of the CZ prior to initiating detonation. • If a marine mammal is observed entering or within the relevant CZs prior to the initiation of detonation activity, the detonation must be delayed. • The detonation may commence when either the marine mammal(s) has voluntarily left the respective CZ and been visually confirmed beyond that CZ, or, when 60 min have elapsed without redetection for whales, including the NARW, or 15 min have elapsed without redetection of sea turtles, dolphins, porpoises, and seals.	Construction	Same as above
54	UXO detonation – Noise attenuation system	As feasible, Revolution Wind will use a NAS for all detonation events and is committed to achieving the modeled ranges associated with 10 dB of noise attenuation (LGL 2022). If a NAS system is not feasible, Revolution Wind will implement mitigation measures for the larger unmitigated zone sizes, with deployment of vessels or use of an aerial platform adequate to cover the entire CZ (see EPM #51).	Construction	This mitigation measure would avoid and minimize adverse impacts to ESA-listed marine mammals, sea turtles, and fish from UXO detonation, where practicable.
55	UXO detonation – Sound measurements	Received sound measurements will be collected during UXO detonations. The measurement plan will be similar to that described for impact pile driving (see EPM #28), which is designed to collect data on approximate source levels, the directionality of the sounds produced, and transmission loss in at least one direction. The distances at which acoustic recorders are placed from the UXO detonation will be determined based on the modeled distances to Level A and Level B thresholds for the applicable UXO size being detonated.	Construction	This monitoring measure would not minimize the potential for adverse effects but would ensure the effectiveness of the required mitigation and

E3PM #	EPM	Description	Project Phase	Anticipated Effect
		The goals of the field verification measurements include verification of modeled ranges to the Level A harassment and Level B harassment isopleths and providing sound measurements of UXO detonations using ISO standard methodology (ISO 2017) for comparison among projects and informing future operations		monitoring measures for marine mammals, sea turtles, and ESA-listed fish from impact pile driving.
56	Fisheries and benthic habitat monitoring – General measures	Revolution Wind is partnering with scientists from Commercial Fisheries Research Center to execute the survey. CFRF has applied for an Exempted Fishing Permit from NOAA Fisheries to use the hired fishing vessels to conduct scientific sampling that is not subject to the Atlantic Coastal Fisheries Cooperative Management Act, Magnuson-Stevens Fishery Conservation and Management Act, and fishery regulations in 50 CFR parts 648 and 697. However, the EFP was not approved, and the commencement of the survey has been delayed as the project team seeks to obtain the necessary scientific research permits to execute the survey. Fisheries monitoring was designed in accordance with recommendations set forth in "Guidelines for Providing Information on Fisheries for Application for Renewable Energy Development on the Atlantic Outer Continental Shelf" (BOEM 2019) and consideration to the Responsible Offshore Science Alliance (ROSA) Offshore Wind Project Monitoring Framework and Guidelines. All survey activities will be subject to rules and regulations outlined under the MMPA and ESA. Efforts will be taken to reduce marine mammal, sea turtle, and seabird injuries and mortalities caused by incidental interactions with sampling gear. All gear restrictions, closures, and other regulations set forth by take reduction plans (e.g., Harbor Porpoise Take Reduction Plan, Atlantic Large Take Whale Reduction Plan, etc.) will be adhered to as with typical scientific fishing operations to reduce the potential for interaction or injury.		
57	Fisheries and benthic habitat monitoring – Ventless trap surveys	Revolution Wind will follow requirements described in the Atlantic Large Whale Take Reduction Plan (NOAA 2018) for the trap and pot fisheries. At a minimum, the following measures will be used to avoid interactions between the ventless trap survey and marine mammals: • No buoy line will be floating at the surface. • All sampling gear will be hauled at least once every 30 days, and all gear will be removed from the water at the end of each sampling season (November). • All groundlines will be constructed of sinking line. • Fishermen contracted to perform the field work will be encouraged to use knot-free buoy lines. • To reduce the potential for moderate or significant risk to right whales (should an entanglement occur) buoy/end lines with a breaking strength of <1700lbs will be used. All buoy line will use weak links that are chosen from the list of NMFS approved gear. This may be accomplished by using whole buoy line that has a breaking strength of 1700lbs; or buoy line with weak inserts that result in line having an overall breaking strength of 1700lbs. • All buoys will be labeled as research gear, and the scientific permit number will be written on the buoy. All markings on the buoys and buoy lines will be compliant with the regulations, and all buoy markings will comply with instructions received by staff at NOAA Greater Atlantic Regional Fisheries Office Protected Resources Division. • Any lines or trawls that go missing will be reported to the NOAA Greater Atlantic Regional Fisheries Office Protected Resources Division as soon as possible.	Pre-construction, Construction, O&M	This mitigation measure would avoid the potential for adverse effects on marine mammals and sea turtles from fisheries monitoring activities.
58	Fisheries and benthic habitat monitoring – Ventless trap surveys	• Marine mammal monitoring will be conducted by the captain and/or a member of the scientific crew before, during, and after haul back. • Trawl operations will commence as soon as possible once the vessel arrives on station; the target tow time will be limited to 20 minutes. • Revolution Wind will initiate marine mammal watches (visual observation) within 1 nautical mile (1852 meters) of the site 15 minutes prior to sampling. • If a marine mammal is sighted within 1 nautical mile (1,852 meters) of the planned sampling station in the 15 minutes before gear deployment, Revolution Wind will delay setting the trawl until marine mammals have not been resighted for 15 minutes or Revolution Wind may move the vessel away from the marine mammal to a different section of the sampling area. If, after moving on, marine mammals are still visible from the vessel, Revolution Wind may decide to move again or to skip the sampling station. • Revolution Wind will maintain visual monitoring effort during the entire period of time that trawl gear is in the water (i.e., throughout gear deployment, fishing, and retrieval). If marine mammals are sighted before the gear is fully removed from the water, (i.e., prior to haul back) the vessel will slow its speed and steer away from the sighted animal in order to minimize potential interactions. Further mitigating actions can be taken following consultation with and guidance from the NMFS Protected Resources Division. • Revolution Wind will open the codend of the net close to the deck/sorting area to avoid damage to animals that may be caught in gear. • Gear will be emptied as close to the deck/sorting area and as quickly as possible after retrieval. • Trawl nets will be fully cleaned and repaired (if damaged) before setting again.	Pre-construction, Construction, O&M	This mitigation measure would avoid the potential for adverse effects on marine mammals from fisheries monitoring activities

E3PM #	EPM	Description	Project Phase	Anticipated Effect
		• Revolution Wind does not anticipate and is not requesting take of marine mammals incidental to research trawl surveys but, in the case of a marine mammal interaction, the Marine Mammal Stranding Network will be contacted immediately.		
59	Fisheries and benthic habitat monitoring – Acoustic telemetry surveys	• No specific mitigation relevant to this type of survey • Vessel mitigation measures outlined above for all Project vessels will be employed while collecting samples.	Pre-construction, Construction, O&M	n/a

Table C-2. Additional mitigation, monitoring, and reporting measures proposed by BOEM, BSEE, and USACE.

Measure #	Measure	Description	Project Phase	Anticipated Enforcement Entity
1	Marine debris awareness training	The Lessee would ensure that vessel operators, employees, and contractors engaged in offshore activities pursuant to the approved COP complete marine trash and debris awareness training annually. The training consists of two parts: (1) viewing a marine trash and debris training video or slide show (described below); and (2) receiving an explanation from management personnel that emphasizes their commitment to the requirements. The marine trash and debris training videos, training slide packs, and other marine debris related educational material may be obtained at https://www.bsee.gov/debris or by contacting BSEE. The training videos, slides, and related material may be downloaded directly from the website. Operators engaged in marine survey activities would continue to develop and use a marine trash and debris awareness training and certification process that reasonably assures that their employees and contractors are in fact trained. The training process would include the following elements: • Viewing of either a video or slide show by the personnel specified above; • An explanation from management personnel that emphasizes their commitment to the requirements; • Attendance measures (initial and annual); and • Recordkeeping and the availability of records for inspection by DOI. By January 31 of each year, the Lessee would submit to DOI an annual report that describes its marine trash and debris awareness training process and certifies that the training process has been followed for the previous calendar year. The Lessee would send the reports via email to BOEM (at renewable_reporting@boem.gov) and to BSEE (at marinedebris@bsee.gov).	Construction, O&M, and decommissioning	BOEM, the Bureau of Safety and Environmental Enforcement (BSEE), and USACE
2	Marine debris elimination	Marking: Materials, equipment, tools, containers, and other items used in OCS activities which are of such shape or properly secured to prevent loss overboard. All markings must clearly identify the owner and must be durable enough to resist the effects of the environmental conditions to which they may be exposed.	Construction and post-construction	BOEM, BSEE, and USACE
3	Incorporate LOA requirements	The measures required by the final MMPA Letter of Authorization (LOA) for Incidental Take Regulations would be incorporated into COP approval, and BOEM and/or BSEE will monitor compliance with these measures.	Construction and post-construction	BOEM and BSEE
4	PAM monitoring methods	Use PAM buoys or autonomous PAM devices to record ambient noise, marine mammals, and cod vocalizations in the Lease Area before, during, and immediately after construction (at least 3 years of operation) to monitor Project noise. The archival recorders must have a minimum capability of detecting and storing acoustic data on anthropogenic noise sources (such as vessel noise, pile driving, WTG operation, and whale detections), marine mammals, and cod vocalizations in the Lease Area. Monitoring would also occur during the decommissioning phase. The total number of PAM stations and array configuration will depend on the size of the zone to be monitored, the amount of noise expected in the area, and the characteristics of the signals being monitored to accomplish both monitoring during constructions, and also meet post-construction monitoring needs. Results must be provided within 90 days of construction completion and again within 90 days of the 1-year, 2-year, and 3-year anniversary of collection. The underwater acoustic monitoring must follow standardized measurement and processing methods and visualization metrics developed by the Atlantic Deepwater Ecosystem Observatory Network (ADEON) for the U.S. Mid- and South Atlantic OCS (see https://adeon.unh.edu/). At least two buoys must be independently deployed within or bordering the Lease Area or one or more buoys must be deployed in coordination with other acoustic monitoring efforts in the RI and MA Lease Areas.	Construction, O&M, and decommissioning	BOEM, BSEE, and NMFS
5	PAM plan	BOEM, BSEE, and USACE would ensure that Revolution Wind prepares a PAM Plan that describes all proposed equipment, deployment locations, detection review methodology and other procedures, and protocols related to the required use of PAM for monitoring. This plan would be submitted to NMFS, BOEM and BSEE (at OSWsubmittals@bsee.gov) for review and concurrence at least 180 days prior to the planned start of pile driving. EFH conservation recommendations for PAM would be incorporated into the plan, and BOEM and/or BSEE will monitor compliance with these measures.	Construction, post-construction monitoring	BOEM, BSEE, and NMFS
6	Pile driving restrictions	BOEM would restrict pile driving from January through April, with addition of December with contingencies. Revolution Wind would be required to develop an adaptive acoustic monitoring plan for spawning Atlantic cod from November through March, including restrictions on Project activities if Atlantic cod aggregations indicative of spawning are detected.	Construction	BOEM, BSEE, and USACE
7	Pile driving monitoring plan	BOEM would ensure that Revolution Wind prepare and submit a *Pile Driving Monitoring Plan* to NMFS and BSEE (at OSWsubmittals@bsee.gov) for review and concurrence at least 180 days before start of pile driving.	Construction	BOEM, BSEE, and NMFS
8	PSO coverage	BOEM, BSEE, and USACE would ensure that PSO coverage is sufficient to reliably detect marine mammals and sea turtles at the surface in clearance and SZs to execute any pile driving delays or shutdown requirements. If, at any point prior to or during construction, the PSO coverage that is included as part of the proposed action is determined not to be sufficient to reliably detect ESA-listed whales and sea turtles within the clearance and SZs, additional PSOs and/or platforms would be deployed. Determinations prior to construction would be based on review of the *Pile Driving Monitoring Plan*. Determinations during construction would be based on review of the weekly pile driving reports and other information, as appropriate.	Construction	BOEM, BSEE, and USACE

Measure #	Measure	Description	Project Phase	Anticipated Enforcement Entity
9	Sound field verification	BOEM, BSEE, and USACE would ensure that if the clearance and/or SZs are expanded, PSO coverage is sufficient to reliably monitor the expanded clearance and/or SZs. Additional observers would be deployed on additional platforms for every 1,500 m that a clearance or SZ is expanded beyond the distances modeled prior to verification. To validate the estimated sound field, sound field verification measurements will be conducted during pile driving of the first three monopiles installed over the course of the Project, with noise attenuation activated. A Sound Field Verification Plan will be submitted to NMFS, BOEM, and BSEE for review and approval at least 90 days prior to planned start of pile driving. This plan will describe how Revolution Wind will ensure that the first three monopile installation sites selected for sound field are representative of the rest of the monopile installation sites and, in the case that they are not, how additional sites will be selected for sound field verification. This plan will also include methodology for collecting, analyzing, and preparing sound field verification data for submission to NMFS. The plan will describe how the effectiveness of the sound attenuation methodology will be evaluated based on the results. In the event that Revolution Wind obtains technical information that indicates a subsequent monopile is likely to produce larger sound fields, sound field verification will be conducted for those subsequent monopiles.	Construction	BOEM, BSEE, USACE, and NMFS
10	Shutdown zones and clearance zone adjustment	BOEM, BSEE, and NMFS may consider adjustments in the pre-start clearance and/or SZs based on the initial sound field verification (sound field verification) measurements. Revolution Wind will provide the initial results of the sound field verification measurements to NMFS in an interim report after each monopile installation for the first three piles as soon as they are available but no later than 48 hours after each installation. Revolution Wind will conduct a sound field verification to empirically determine the distances to the isopleths corresponding to Level A harassment and Level B harassment thresholds, including at the locations corresponding to the modeled distances to the Level A harassment and Level B harassment thresholds. If initial sound field verification measurements indicate distances to the isopleths are less than the distances predicted by modeling assuming 10 dB attenuation, Revolution Wind may request a modification of the clearance and SZs for impact pile driving. For a modification request to be considered by NMFS, Revolution Wind must have conducted sound field verification on at least three piles to verify that zone sizes are consistently smaller than predicted by modeling. If initial sound field verification measurements indicate distances to the isopleths are greater than the distances predicted by modeling, Revolution Wind will implement additional sound attenuation measures prior to conducting additional pile driving. Additional measures may include improving the efficacy of the implemented noise attenuation technology and/or modifying the piling schedule to reduce the sound source. If modeled zones cannot be achieved by these corrective actions, Revolution Wind will install an additional noise mitigation system to achieve the modelled ranges. Each sequential modification will be evaluated empirically by sound field verification. Additionally, in the event that sound field verification measurements continue to indicate distances to isopleths corresponding to Level A harassment and Level B harassment thresholds are consistently greater than the distances predicted by modeling, NMFS may expand the relevant clearance and SZs and associated monitoring measures.	Construction	BOEM, BSEE, USACE, and NMFS
11	Monitoring zone for sea turtles	BOEM, BSEE, and USACE would ensure that Revolution Wind monitors the full extent of the area where noise would exceed the 175 dB re 1 µPa^2 threshold for sea turtles for the full duration of all pile driving activities and for 30 minutes following the cessation of pile driving activities and record all observations in order to ensure that all take that occurs is documented.	Construction	BOEM, BSEE, and USACE
12	Reporting of all NARW sightings	If a NARW is observed at any time by PSOs or personnel on any Project vessels, during any Project-related activity or during vessel transit, Revolution Wind must report the sighting information to NMFS as soon as feasible and no later than within 24 hours after conclusion of the detection event (the time, location, and number of animals) via the WhaleAlert app (http://www.whalealert.org/); NMFS Right Whale Sighting Advisory System hotline (phone); and PR.ITP.MonitoringReports@noaa.gov.	Construction, O&M, and decommissioning	BOEM, BSEE, USACE, and NMFS
13	Vessel strike avoidance measures for sea turtles	Between June 1 and November 30, Revolution Wind would have a trained lookout posted on all vessel transits during all phases of the Project to observe for sea turtles. The trained lookout would communicate any sightings, in real time, to the captain so that the requirements in (e) below can be implemented. a. The trained lookout would monitor https://seaturtlesightings.org/ prior to each trip and report any observations of sea turtles in the vicinity of the planned transit to all vessel operators/captains and lookouts on duty that day. b. The trained lookout would maintain a vigilant watch and monitor a Vessel Strike Avoidance Zone (500 m) at all times to maintain minimum separation distances from ESA-listed species. Alternative monitoring technology (e.g., night vision, thermal cameras, etc.) would be available to ensure effective watch at night and in any other low visibility conditions. If the trained lookout is a vessel crew member, this would be their designated role and primary responsibility while the vessel is transiting. Any designated crew lookouts would receive training on protected species identification, vessel strike minimization procedures, how and when to communicate with the vessel captain, and reporting requirements. c. If a sea turtle is sighted within 100 m or less of the operating vessel's forward path, the vessel operator would slow down to 4 knots (unless unsafe to do so) and then proceed away from the turtle at a speed of 4 knots or less until there is a separation distance of at least 100 m at which time the vessel may resume normal operations. If a sea turtle is sighted within 50 m of the forward path of the operating vessel, the vessel operator would shift to neutral when safe to do so and then proceed away from the turtle at a speed of 4 knots. The vessel may resume normal operations once it has passed the turtle. d. Vessel captains/operators would avoid transiting through areas of visible jellyfish aggregations or floating sargassum lines or mats. In the event that operational safety prevents avoidance of such areas, vessels would slow to 4 knots while transiting through such areas. e. All vessel crew members would be briefed in the identification of ESA-listed species of sea turtles and in regulations and best practices for avoiding vessel collisions. Reference materials would be available aboard all Project vessels for identification of sea turtles. The expectation and process for reporting of	Construction, O&M, and decommissioning	BOEM, BSEE, and USACE

Measure #	Measure	Description	Project Phase	Anticipated Enforcement Entity
		sea turtles (including live, entangled, and dead individuals) would be clearly communicated and posted in highly visible locations aboard all Project vessels, so that there is an expectation for reporting to the designated vessel contact (such as the lookout or the vessel captain), as well as a communication channel and process for crew members to do so. f. The only exception is when the safety of the vessel or crew necessitates deviation from these requirements on an emergency basis. If any such incidents occur, they must be reported to NMFS and BSEE within 24 hours. g. If a vessel is carrying a PSO or trained lookout for the purposes of maintaining watch for North Atlantic right whales, an additional lookout is not required and this PSO or trained lookout must maintain watch for whales, giant manta rays, and sea turtles.		
14	Vessel speed restriction	BOEM will require Revolution Wind to comply with NMFS's vessel strike avoidance and reporting measures included in the final MMPA ITR and ESA Biological Opinion.	Construction, O&M	BOEM, BSEE, and USACE
15	Sampling gear	All sampling gear would be hauled out at least once every 30 days, and all gear would be removed from the water and stored on land between survey seasons to minimize risk of entanglement.	Construction, post-construction monitoring	BOEM and BSEE
16	Lost survey gear	If any survey gear is lost, all reasonable efforts that do not compromise human safety would be undertaken to recover the gear. All lost gear would be reported to NMFS (nmfs.gar.incidental-take@noaa.gov) and BSEE (OSWIncidentReporting@bsee.gov) within 24 hours of the documented time of missing or lost gear. This report would include information on any markings on the gear and any efforts undertaken or planned to recover the gear.	Construction, post-construction monitoring	BOEM, BSEE, and NMFS
17	Training	At least one of the survey staff onboard the trawl surveys and ventless trap surveys would have completed NEFOP observer training (within the last 5 years) or other training in protected species identification and safe handling (inclusive of taking genetic samples from Atlantic sturgeon). Reference materials for identification, disentanglement, safe handling, and genetic sampling procedures would be available on board each survey vessel. BOEM and BSEE would ensure that Revolution Wind prepares a training plan that addresses how this requirement would be met and that the plan is submitted to NMFS in advance of any trawl or trap surveys. This requirement is in place for any trips where gear is set or hauled.	Construction, post-construction monitoring	BOEM, BSEE, and NMFS
18	Sea turtle disentanglement	Vessels deploying fixed gear (e.g., pots/traps) would have adequate disentanglement equipment (i.e., knife and boathook) onboard. Any disentanglement would occur consistent with the Northeast Atlantic Coast STDN Disentanglement Guidelines at https://www.reginfo.gov/public/do/DownloadDocument?objectID=102486501 and the procedures described in "Careful Release Protocols for Sea Turtle Release with Minimal Injury" (NOAA Technical Memorandum 580; https://repository.library.noaa.gov/view/noaa/3773).	Construction, post-construction monitoring	BOEM, BSEE, and NMFS
19	Sea turtle/Atlantic sturgeon identification and data collection	Any sea turtles or Atlantic sturgeon caught and/or retrieved in any fisheries survey gear would first be identified to species or species group. Each ESA-listed species caught and/or retrieved would then be properly documented using appropriate equipment and data collection forms. Biological data, samples, and tagging would occur as outlined below. Live, uninjured animals should be returned to the water as quickly as possible after completing the required handling and documentation. a. The Sturgeon and Sea Turtle Take Standard Operating Procedures would be followed (https://media.fisheries.noaa.gov/dammigration/sturgeon_&_sea_turtle_take_sops_external.pdf). b. Survey vessels would have a passive integrated transponder (PIT) tag reader onboard capable of reading 134.2 kHz and 125 kHz encrypted tags (e.g., Biomark GPR Plus Handheld PIT Tag Reader) and this reader be used to scan any captured sea turtles and sturgeon for tags. Any recorded tags would be recorded on the take reporting form (see below). c. Genetic samples would be taken from all captured Atlantic sturgeon (alive or dead) to allow for identification of the DPS of origin of captured individuals and tracking of the amount of incidental take. This would be done in accordance with the Procedures for Obtaining Sturgeon Fin Clips (https://media.fisheries.noaa.gov/dammigration/ sturgeon_genetics_sampling_revised_june_2019.pdf). i. Fin clips would be sent to a NMFS approved laboratory capable of performing genetic analysis and assignment to DPS of origin. To the extent authorized by law, BOEM is responsible for the cost of the genetic analysis. Arrangements would be made for shipping and analysis in advance of submission of any samples; these arrangements would be confirmed in writing to NMFS within 60 days of the receipt of this ITS. Results of genetic analysis, including assigned DPS of origin would be submitted to NMFS within 6 months of the sample collection. ii. Subsamples of all fin clips and accompanying metadata forms would be held and submitted to a tissue repository (e.g., the Atlantic Coast Sturgeon Tissue Research Repository) on a quarterly basis. The Sturgeon Genetic Sample Submission Form is available for download at: https://www.fisheries.noaa.gov/new-england- midatlantic/consultations/section-7-take-reporting-programmaticsgreater-atlantic). d. All captured sea turtles and Atlantic sturgeon would be documented with required measurements and photographs. The animal's condition and any marks or injuries would be described. This information would be entered as part of the record for each incidental take. A NMFS Take Report Form would be filled out for each individual sturgeon and sea turtle (download at: https://media.fisheries.noaa.gov/2021-41507/Take%20Report%20Form%2007162021.pdf?null) and submitted to NMFS as described below.	Construction, post-construction monitoring	BOEM, BSEE, USACE, and NMFS

Measure #	Measure	Description	Project Phase	Anticipated Enforcement Entity
20	Sea turtle/Atlantic sturgeon handling and resuscitation guidelines	Any sea turtles or Atlantic sturgeon caught and retrieved in gear used in fisheries surveys would be handled and resuscitated (if unresponsive) according to established protocols and whenever at-sea conditions are safe for those handling and resuscitating the animal(s) to do so. Specifically: a. Priority would be given to the handling and resuscitation of any sea turtles or sturgeon that are captured in the gear being used, if conditions at sea are safe to do so. Handling times for these species should be minimized (i.e., kept to 15 minutes or less) to limit the amount of stress placed on the animals. b. All survey vessels would have copies of the sea turtle handling and resuscitation requirements found at 50 CFR 223.206(d)(1) prior to the commencement of any on-water activity (download at: https://media.fisheries.noaa.gov/ dammigration/sea_turtle_handling_and_resuscitation_measures.pdf). These handling and resuscitation procedures would be carried out any time a sea turtle is incidentally captured and brought onboard the vessel during the proposed actions. c. If any sea turtles that appear injured, sick, or distressed, are caught and retrieved in fisheries survey gear, survey staff would immediately contact the Greater Atlantic Region Marine Animal Hotline at 866-755-6622 for further instructions and guidance on handling the animal, and potential coordination of transfer to a rehabilitation facility. If unable to contact the hotline (e.g., due to distance from shore or lack of ability to communicate via phone), the USCG should be contacted via VHF marine radio on Channel 16. If required, hard-shelled sea turtles (i.e., non- leatherbacks) may be held on board for up to 24 hours following handling instructions provided by the Hotline, prior to transfer to a rehabilitation facility. d. Attempts would be made to resuscitate any Atlantic sturgeon that are unresponsive or comatose by providing a running source of water over the gills as described in the Sturgeon Resuscitation Guidelines (https://media.fisheries.noaa.gov/dammigration-miss/Resuscitation-Cards-120513.pdf). e. Provided that appropriate cold storage facilities are available on the survey vessel, following the report of a dead sea turtle or sturgeon to NMFS, and if NMFS requests, any dead sea turtle or Atlantic sturgeon would be retained on board the survey vessel for transfer to an appropriately permitted partner or facility on shore as safe to do so. f. Any live sea turtles or Atlantic sturgeon caught and retrieved in gear used in any fisheries survey would ultimately be released according to established protocols and whenever at-sea conditions are safe for those releasing the animal(s) to do so.	Construction, post-construction monitoring	BOEM, BSEE, USACE, and NMFS
21	Take notification	GARFO PRD would be notified as soon as possible of all observed takes of sea turtles, and Atlantic sturgeon occurring as a result of any fisheries survey. Specifically: a. GARFO PRD would be notified within 24 hours of any interaction with a sea turtle or sturgeon (nmfs.gar.incidental- take@noaa.gov and BSEE at protectedspecies@bsee.gov). The report would include at a minimum: (1) survey name and applicable information (e.g., vessel name, station number); (2) GPS coordinates describing the location of the interaction (in decimal degrees); (3) gear type involved (e.g., bottom trawl, gillnet, longline); (4) soak time, gear configuration and any other pertinent gear information; (5) time and date of the interaction; and (6) identification of the animal to the species level. Additionally, the e-mail would transmit a copy of the NMFS Take Report Form (available at: https://media.fisheries.noaa.gov/2021-07/Take%20Report%20Form%20 07162021.pdf) and a link to or acknowledgement that a clear photograph or video of the animal was taken (multiple photographs are suggested, including at least one photograph of the head scutes). If reporting within 24 hours is not possible due to distance from shore or lack of ability to communicate via phone, fax, or email, reports would be submitted as soon as possible; late reports would be submitted with an explanation for the delay. b. At the end of each survey season, a report would be sent to NMFS that compiles all information on any observations and interactions with ESA-listed species. This report would also contain information on all survey activities that took place during the season including location of gear set, duration of soak/trawl, and total effort. The report on survey activities would be comprehensive of all activities, regardless of whether ESA-listed species were observed.	Construction, post-construction monitoring	BOEM, BSEE, USACE, and NMFS
22	Data collection BA BMPs	BOEM and BSEE would ensure that all Project Design Criteria and Best Management Practices incorporated in the Atlantic Data Collection consultation for Offshore Wind Activities (June 2021) shall be applied to activities associated with the construction, maintenance and operations of the Revolution Wind Project as applicable. https://www.boem.gov/pdcs-and-bmps-atlantic-data-collection-11222021	Construction, O&M, and decommissioning	BOEM and BSEE
23	Monthly/ annual reporting requirements	BOEM and BSEE would ensure that Revolution Wind submits regular reports (in consultation with NMFS) necessary to document the amount or extent of take that occurs during all phases of the proposed action. Details of reporting would be coordinated between Revolution Wind, NMFS, BOEM and BSEE. All reports would be sent to: nmfs.gar.incidental- take@noaa.gov and BSEE at OSWsubmittals@bsee.gov.	Construction, O&M, and decommissioning	BOEM, BSEE, and NMFS
24	Vessel strike avoidance plan measures	BOEM will require Revolution Wind to comply with NMFS's vessel strike avoidance and reporting measures included in the final MMPA ITR and ESA Biological Opinion.	Construction, O&M, and decommissioning	BOEM, BSEE, USACE, and NMFS
25	Vessel speed restriction	BOEM will require Revolution Wind to comply with NMFS's vessel speed restriction and reporting measures included in the final MMPA ITR and ESA Biological Opinion.	Construction, O&M	BOEM, BSEE, USACE, and NMFS

2.0 References

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