Technical Report

Offshore Airborne Sound Assessment

Revolution Wind Offshore Wind Farm

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Executive Summary

VHB has conducted an airborne sound assessment of the construction and operation of offshore components of the Revolution Wind Farm (RWF) and Revolution Wind Export Cable (RWEC). The report presents background on airborne sound concepts, applicable federal, state, and local noise laws, ordinances, and guidelines, methodologies used to evaluate construction and operational sound, an assessment of how the project will comply with relevant noise standards, and an evaluation of the need for practicable operational and/or construction-period best management practices (BMPs) to minimize potential airborne noise effects.

The U.S. Environmental Protection Agency (EPA) has noise guidelines (*"Information on the Levels of Environmental Noise Requisite to Protect Public Health and Welfare with an Adequate Margin of Safety"*) which recommend limiting operational noise to a day-night average sound level of 55 dBA (Ldn) which is equivalent to a constant equivalent sound level of 48.6 dBA (Leq). The State of Rhode Island general laws (Chapter 11-45) do not include quantitative noise limits and defer to municipalities to establish and enforce noise limits. The Massachusetts Department of Environmental Protection (MassDEP) noise regulations (310 CMR 7.10) prohibits sources of sound that increases the broadband sound level by more than 10 dBA above ambient sound levels (normally defined as L90 or the noise level exceeded 90 percent of the time during the hours of noise source operation) or which produce a "pure tone" conditions, which is when any octave band center frequency sound pressure level exceeds the two adjacent frequency sound pressure levels by three decibels or more. Municipal residential sound level limits in Rhode Island and Massachusetts typically range from 50 to 60 dBA during the day and 55 to 65 dBA during the night. The Town of Middletown has zoning ordinances and design standards for wind turbines (Section 25A04 part D) which states that noise levels resulting from operation of a wind turbine shall not exceed 30 dBA as measured at the property line and averaged over a ten-minute time period.

Municipalities which have shorelands surrounding the WTGs in Rhode Island include the Town of New Shoreham, the Town of South Kingston, Town of Narraganset, Town of Jamestown, City of Newport, Town of Middletown, and the Town of Little Compton and in Massachusetts include the Town of Westport, Town of Dartmouth, Town of Gosnold, Town of Aquinnah, Town of Chilmark, and the Town of West Tisbury. Ambient sound levels range from 25 to 45 dBA during the night and 35 to 55 dBA during the day based on population densities of these communities.

Operational sound generated by offshore components of the RWF and RWEC include operation of the proposed WTGs with two OSSs and nautical hazard prevention devices (foghorns). Sound levels from the operation of the WTGs would be 27.3 dBA or less at all shoreline locations. The highest sound level from the operation of the WTGs would be at the shoreline in Aquinnah, Massachusetts. The potential increase in sound level would be 4 dBA or less at during the nighttime at all locations which would be substantially below the

MassDEP noise criteria of no more than a 10-dBA increase. Sound levels would also be below the 30-dBA limit for wind turbines in the Town of Middletown, Rhode Island. Sound has been conservatively assessed from all the foghorns sounding simultaneously and for individual fog horns closest to the shorelines. The highest received sound level from all fog horns sounding simultaneously would be 15.1 dBA at the Town of Chilmark, Massachusetts which would be substantially lower than existing ambient conditions. The highest received sound level from an individual foghorn sounding would be 12.1 dBA for the easternmost foghorn. These sound levels are also well below the EPA noise guideline and all local noise ordinances. Therefore, the operation of the WTGs and use of foghorns would comply with all federal, state, and local noise regulations and there is no need for measures to avoid, minimize or mitigate operational noise.

Offshore construction activities will include vessels and helicopters to transport materials and people to and from the Project site and impact pile driving for the foundations of the WTGs and OSSs. Installation of the offshore export cable will progress at approximately 200 to 800 meters per hour, so vessels would not be near a particular onshore area for an extended period of time and no significant noise effects are anticipated from airborne vessel noise. Helicopters will be used for additional crew transfers during foundation construction activities and the O&M phase. The helicopter route plan will be developed to meet industry guidelines and best practices in accordance with FAA guidance. These types of helicopter operations will generate sound similar to aircrafts already operating in the airspace.

Construction sound from pile driving has been evaluated conservatively assuming simultaneous pile driving at four one WTGs in close proximity to each other. Pile driving noise has been evaluated at the eastern, northern, western, and southern ends of the WTGs. Pile driving would be 16.411.2 dBA or less at the nearest shorelines. At these low levels, sound from the pile driving activities would likely not be audible at the shorelines. Construction sound would comply with relevant federal, state, and local noise standards and there is no need for measures to avoid, minimize or mitigate construction noise.

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Acronyms and Abbreviations

ASTM	American Society for Testing and Materials
BOEM	Bureau of Ocean Energy Management
CFR	Code of Federal Regulations
CRMC	Rhode Island Coastal Resources Management Council
dBA	A-weighted decibel
dB	Un-weighted decibel
EPA	U.S. Environmental Protection Agency
GIS	Geographic information system
HDD	Horizontal directional drilling
HVAC	High-voltage alternating current
Hz	Hertz
ISO	Organization for International Standardization
kHz	kilohertz
kJ	kiloJoule
km	kilometer
Ldn	Day-night average sound level
Leq	Equivalent sound level
Lmax	Maximum sound level
Lmin	Minimum sound level
Ln	Statistical sound level
Mi	Mile
NEMA	National Electrical Manufacturers Association
nm	Nautical mile
NSR	Noise sensitive receptor
Ocean SAMP	Ocean Special Area Management Plan
OSS	Offshore substation
OnSS	On-shore substation and interconnection facility

RI CRMC	Rhode Island Coastal Resources Management Council
RIDEM	Rhode Island Department of Environmental Management
RWF	Revolution Wind Farm
RWEC	Revolution Wind Farm Export Cable
USGS	United States Geological Survey
WTG	Wind turbine generator

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1 Introduction

This Offshore Airborne Sound Assessment Technical Report ("report") includes background information on airborne sound level concepts, applicable federal, state, and local regulations, and ordinances and standards related to noise. This report also presents the methodologies for analyzing operational and construction airborne sound and an assessment of the potential effects of operational and construction sound due to the Project, and an evaluation of the need for practicable operational and/or construction-period best management practices (BMPs) to minimize potential airborne noise effects.

1.1 Project Description

Revolution Wind, LLC (Revolution Wind) proposes to construct and operate the Revolution Wind Farm Project (Project). The wind farm portion of the Project will be located in federal waters on the Outer Continental Shelf (OCS) in the designated Bureau of Ocean Energy Management (BOEM) Renewable Energy Lease Area OCS-A 0486, approximately 20 statute miles (mi) (17.4 nautical miles [nm], 30 kilometers [km]) south of the coast of Rhode Island.

In accordance with the BOEM Draft Guidance (BOEM, 2018), the Construction and Operations Plan (COP) and the airborne acoustic assessment have been evaluated based on a Project Design Envelopes (PDE) representing a reasonable range of design parameters. The Project generally includes the following: Revolution Wind Farm (RWF), inclusive of up to 100 wind turbine generators (WTGs), up to two offshore substations (OSSs), Inter-Array Cables, and OSS Interconnector Cable; up to two submarine export cables (referred to as the Revolution Wind Export Cable [RWEC]), inclusive of up to 25 mi (40 km) in federal waters and up to 23 mi (37 km) Rhode Island state waters; and onshore facilities, inclusive of an up to

500-ft (152-m) segment of the RWEC, onshore transmission cable, and an onshore substation. Refer to Section 3 of the Project's COP for a complete description of the PDE. This report evaluates airborne sound expected from construction and operation of the RWF and RWEC.

1.2 Airborne Sound Concepts and Terminology

Sound is the rapid fluctuation of pressure above and below the ambient conditions and can occur in any medium such as air or water. When sound becomes unwanted, it is defined as noise. Sound becomes an adverse impact when it interferes with the normal habits or activities of fish, wildlife or people. Sound is described based on its loudness or intensity (sound level), the frequencies of sound, and the variation of sound over time. Sound levels are most often measured on a logarithmic scale of decibels (dB) relative to 20 micro-Pascals in air and relative to 1 micro-Pascal in water. Since airborne and underwater sound levels are based on different reference levels, they should not be directly compared. For some activities, such as pile driving for foundations, both airborne and underwater sound will be generated.

Airborne sound can have a range of effects on humans including speech interference, sleep interference, annoyance, and physiological effects such as anxiety or tinnitus and at high amplitudes could result in pain or hearing loss. Potential effects from underwater sound on fish and mammals include altering their behavior, disrupting their functions or physiology, causing injury or resulting in mortality. Behavioral effects from sound may include causing fish to be startled, moving away from typical habitats, reducing the ability to locate prey, or inability to communicate. Physiological effects may include stress, temporary hearing loss, or cellular changes to organs such as a fish's swim bladder, eyes or brain. The severity of these effects depends on the intensity and characteristics of underwater sound and the size and type of fish present.

Airborne sound is the rapid fluctuations of air pressure above and below ambient pressure levels. Noise is defined as unwanted or excessive sound. Sound becomes unwanted when it interferes with normal activities such as sleep, work, communication, or recreation. How people perceive sound depends on several measurable physical characteristics, including:

- **Sound Level** – Sound level is based on the amplitude change in pressure and is related to the loudness or intensity. Human hearing covers a wide range of changes in sound pressure amplitude. Therefore, sound levels are most often measured on a logarithmic scale of decibels (dB) relative to 20 micro-pascals. The dB scale compresses the audible range of acoustic pressure levels, which can vary from the threshold of hearing (0 dB) to the threshold of pain (120 dB). Because sound levels are measured in dB, the addition of two sound levels is not linear. For example, adding two equal sound levels results in a 3-dB increase in the overall level. Research indicates the general relationships between sound level and human perception are as follows:
  - A 3-dB increase is a doubling of acoustic energy and is approximately the smallest difference in sound level that can be perceived in most environments.

- A 10-dB increase is a tenfold increase in acoustic energy and is generally perceived as a doubling in loudness to the average person.

› **Frequency** – Sounds are comprised of acoustic energy distributed over a range of frequencies. Acoustic frequencies, commonly referred to as tone or pitch, are typically measured in Hertz (Hz). Human hearing generally ranges from 20 to 20,000 Hz; however, the human ear does not perceive sound levels from each frequency as equally loud. To compensate for this phenomenon in perception, a frequency filter known as A-weighting is commonly used to evaluate environmental noise levels, and sound levels are denoted as "dBA." Sound is often presented in frequency bands such as octave or one-third octave bands.

› Sound levels reported in octave or one-third-octave frequency bands are often used to describe the frequency content of different sounds. Some sources of sound can generate "pure tones," which is when there is a concentration of sound within a narrow frequency range such as a whistle. Humans can hear pure tones very well, and such conditions can be a cause of increased annoyance.

A variety of sound level descriptors can be used for environmental noise analyses. These descriptors relate to the way sound varies in level over time. The following is a list of common sound level descriptors:

Energy-Average Sound Level (Leq) – Leq is a single value, which represents the same acoustic energy as the fluctuating levels, that exists over a given period of time. The Leq takes into account how loud noise events are during the period, how long they last, and how many times they occur. Leq is commonly used to describe environmental noise and relates well to human annoyance. An Leq over an 8-hour period is commonly used to evaluate construction noise and is denoted Leq[8hr].

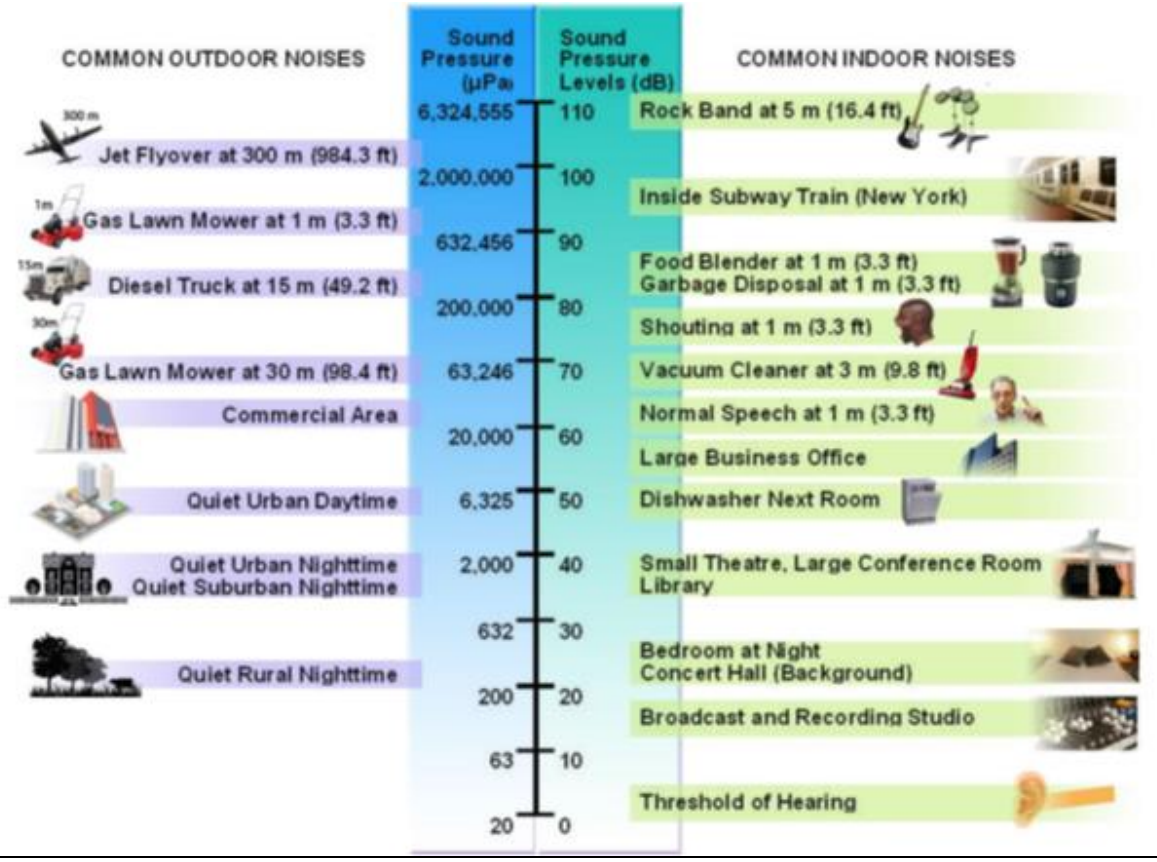
Day-night Average Sound Level (Ldn) – Ldn is similar to the Leq in that it is a single value, which represents the same acoustic energy as the fluctuating levels, that exists over a 24-hour period. The Ldn takes into account how loud sound events are, how long they last, how many times they occur over a 24-hour period, and whether they occur during the day (7:00 AM to 10:00 PM) or night (10:00 PM to 7:00 AM). Sound that occurs during the night is given a 10-dB penalty to account for the increased human sensitivity to noise at night. If sound levels are constant over a 24-hour period, the Ldn level is 6.4 dB greater than the Leq level due to the 10-dB nighttime penalty.

Statistical Sound Levels – Sound level metrics, such as L01, L10, L50 or L90, represent the levels that are exceeded for a particular percentage of time over a given period. For example, L10 is the level that is exceeded for 10 percent of the time. Therefore, it represents the higher end of the range of sound levels. The L90, on the other hand, is the level that is exceeded 90 percent of the time, and therefore, is representative of the background sound level.

Maximum Sound Level (Lmax) – Many sources of sound, including mobile sources and stationary sources, change over time. Stationary sources associated with energy facilities can often generate different sound levels depending on the operational condition of the equipment. It is common to describe sound in terms of the maximum (Lmax) sound level

emissions. **Figure 1.2-1** (FHWA, 2018) presents a list of the maximum sound levels of common outdoor and indoor sources.

Figure 1.2-1 Maximum Airborne Sound Levels of Common Sources



Source: FHWA, 2019

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Regulatory Context

This section describes the federal, state, and local noise laws, regulations, ordinances, and guidelines applicable to the proposed Project. **Table 2.0-1** summarizes the jurisdiction, agency, standard, and residential operational and construction noise limits.

Table 2.0-1 Summary of Applicable Airborne Noise Standards

Jurisdiction	Agency	Standard	Operational Noise Limit (dBA)	Construction Noise Limit (dBA)
Federal	EPA	*Information on the Levels of Environmental Noise Requisite to Protect Public Health and Welfare with an Adequate Margin of Safety*	55 dBA (Ldn) 48.6 dBA (Continuous Leq)	None
State of Rhode Island	General Laws	*Chapter 11-45.1 Unreasonable Noise Levels*	N/A	None
State of Massachusetts	Department of Environmental Protection	310 CMR 7.10 and DAQC Policy 90 001	Ambient (L90) + 10 dBA (Leq) No Pure Tones	None
Town of New Shoreham, Rhode Island		Town Code Chapter 12-1	Residential: 65 dBA 7 AM – 9 PM 55 dBA 9 PM – 7 AM	None
Town of South Kingston, Rhode Island		Town Code Article 5 Section 507.15: Standards for the Regulations of Commercial and Industrial uses	Residential: 60 dBA 7 AM – 9 PM 50 dBA 9 PM – 7 AM	None
Town of Narragansett, Rhode Island		Town Code Chapter 22: Noise	Residential: 65 dBA 7 AM – 10 PM 55 dBA 10 PM – 7 AM	None

Jurisdiction	Agency	Standard	Operational Noise Limit (dBA)	Construction Noise Limit (dBA)
Town of Jamestown, Rhode Island		Town Code Chapter 22: Noise	Residential: 70 dBA 8 AM – 10 PM 60 dBA 10 PM – 8 AM	None
City of Newport, Rhode Island		City Code Chapter 8: Noise Abatement	Residential: 70 dBA 8 AM – 10 PM 60 dBA 10 PM – 8 AM	None
Town of Middletown, Rhode Island		Town Code Chapter 130.75 Noise	Residential: 65 dBA 7 AM – 10 PM 55 dBA 10 PM – 7 AM 30 dBA (wind turbine noise)	None
Town of Little Compton, Rhode Island		Town Code Chapter III Section 3-1	Residential: 55 dBA 7 AM – 9 PM 50 dBA 9 PM – 7 AM	None
Town of Westport, Massachusetts		Town Code Article XL, Noise Pollution	All: 60 dBA 9 PM – 7 AM	None
Town of Dartmouth, Massachusetts		Town Code Part II, Chapter 250, Noise	None	None
Town of Gosnold, Massachusetts		None	None	None
Town of Aquinnah, Massachusetts		None	None	None
Town of Chilmark, Massachusetts		None	None	None
Town of West Tisbury, Massachusetts		General Bylaw	None	None

Sources:
New Shoreham, Rhode Island Town Code Part II, Chapter 12, Noise,
South Kingston, Rhode Island Town Code, Part 3, Appendix A, Article 5, Section 507, February 13, 2019.
Narragansett, Rhode Island Town Code, Chapter 22, Article III, Noise, September 18, 2019.
Jamestown, Rhode Island Town Code, Chapter 22, Article III, Noise, January 23, 2006.
Newport, Rhode Island Municipal Code, Chapter 8.12, Noise Abatement, November 7, 2019.
Middletown, Rhode Island Town Code, Title XIII, Chapter 130, Noise, August 5, 199.
Little Compton, Rhode Island Town Code, Chapter III, Section 3-1, Disturbing the Peace, January 7, 2016.
By-Laws and Regulations of the Town of Westport, Massachusetts Article XL, Noise Pollution Control.
Dartmouth, Massachusetts Town Code, part II, Chapter 250, Noise, August 15, 2001.
West Tisbury, Massachusetts Noise Bylaw.

2.1.1 Federal

The Noise Control Act of 1972 authorized federal agencies to adequately control noise that may endanger the health and welfare of the nation's population. In 1974, the U.S. EPA conducted a study on noise impacts relative to public health and safety (EPA, 1974). This EPA study provides guidance on the potential effects of noise that can be considered by federal, state, and local agencies; however, it does not constitute a standard or regulation.

As shown in **Table 2.1-1**, the EPA study concluded that a day-night average sound level of 55 dBA (Ldn) or less for outdoor residential areas, or 55 dBA (Leq[24]) or less for outdoor areas where people spend limited amounts of time, such as schools and playgrounds, would protect public health and welfare in regard to potential interference with outdoor activity and annoyance. The study also concluded that a sound level of 45 dBA (Ldn) or (Leq[24]) or less for indoor residential uses and schools, respectively, would protect public health and welfare in regard to potential interference and annoyance. Since most buildings with windows closed provide 20 dB or more, and buildings with windows open provide 10 dB of

outdoor-to-indoor sound attenuation, the exterior criteria are more stringent, and noise from the proposed Project will be evaluated according to the outdoor criteria.

The EPA noise guidelines are based on the evaluation of pervasive long-term noise, and therefore, are applied to future operational noise conditions and are not typically applied to short-term construction-period activities.

Table 2.1-1 EPA Noise Levels Identified to Protect Public Health and Welfare

Effect	Level	Area
Outdoor Activity Interference	L_{DN} [55 dBA]	Outdoors in residential areas and farms, other outdoor areas where people spend widely varying amounts of time, and other places in which quiet is a basis for use
	$L_{EQ}(24)$ [55 dBA]	Outdoor areas where people spend limited amounts of time, such as schoolyards, playgrounds, parks, etc.
Indoor Activity Interference and Annoyance	L_{DN} [45 dBA]	Indoor residential areas
	$L_{EQ}(24)$ [45 dBA]	Other areas with human activities, such as schools

Source: EPA, 1974

2.1.2 State

The following summarizes the relevant Rhode Island and Massachusetts state-level laws, regulations, policies, and guidance applicable to the Project.

2.1.2.1 Rhode Island

The State of Rhode Island general laws include a noise policy (Chapter 11-45.1 Unreasonable Noise Levels) which prohibits unreasonable, excessive and annoying noise levels from all sources subject to its police power. The Rhode Island Department of Environmental Management (RIDEM) does not have environmental noise regulations applicable to the Project. Therefore, there are no state-wide quantitative noise criteria for operations or construction of the Project. The State of Rhode Island relies on individual communities to establish noise regulations through local ordinances or community by-laws.

The Rhode Island Coastal Resources Management Council (CRMC) has developed an Ocean Special Area Management Plan (Ocean SAMP) which includes goals for underwater and airborne sound from the operation of offshore wind turbine generators. The goal for airborne sound, which is not a required standard, is for the applicant and manufacturer to minimize the radiated airborne noise from the wind turbines.

2.1.2.2 Massachusetts

The Massachusetts Department of Environmental Protection (MassDEP) has developed noise impact criteria to help protect the public health and welfare from excessive noise. These criteria were used to evaluate whether a facility will generate sound levels that result in adverse impacts. MassDEP policy for implementing its noise regulations (310 CMR 7.10) is contained in DAQC Policy 90 001. This policy states that a source of sound will be violating the Department's noise regulations if the source:

- Increases the broadband sound level by more than 10 dBA above ambient sound levels (normally defined as L90 or the noise level exceeded 90 percent of the time during the hours of noise source operation); or
- Produces a "pure tone" condition, which is when any octave band center frequency sound pressure level exceeds the two adjacent frequency sound pressure levels by three decibels or more.

2.1.3 Local

Municipalities which have shorelands surrounding the WTGs in Rhode Island, include the Town of New Shoreham, the Town of South Kingston, Town of Narraganset, Town of Jamestown, City of Newport, Town of Middletown, and the Town of Little Compton, and in Massachusetts include the Town of Westport, Town of Dartmouth, Town of Gosnold, Town of Aquinnah, Town of Chilmark, and the Town of West Tisbury. While these municipalities are distant to potential sound generated by the construction and operation of the WTGs, potential noise impact has been assessed at these municipalities in regard to their local noise ordinances.

Table 2.1-2 summarizes the relevant municipal noise ordinances applicable to the Project. Residential sound level limits, where applicable, typically range from 50 to 60 dBA during the day and 55 to 65 dBA during the night. The Town of Middletown has zoning ordinances and design standards for wind turbines (Section 25A04 part D) which state that noise levels resulting from operation of a wind turbine shall not exceed 30 dBA as measured at the property line and averaged over a ten-minute time period.

Table 2.1-2 Local Municipal Noise Ordinances

Municipality	Location of Receiving Land Use	Time	Sound Level Limit, dBA
Town of New Shoreham, RI1	Category I: Residential A, B, C Zones Mixed Use Zone	7 AM to 9 PM	65
		9 PM to 7 AM	55
	Category II: New Harbor, Old Harbor, Mixed Use, and Service Commercial Zones	7 AM to 12 AM	70
		12 AM to 7 AM	65
	Category III: Beaches Public Waters	7 AM to 9 PM	65
		9 PM to 7 AM	55
Town of South Kingston, RI2	Residential	7 AM to 9 PM	60
		9 PM to 7 AM	50
	Commercial	7 AM to 9 PM	65
		9 PM to 7 AM	65
	Industrial	7 AM to 9 PM	70
		9 PM to 7 AM	70

Municipality	Location of Receiving Land Use	Time	Sound Level Limit, dBA
Town of Narragansett, RI3	Residential	7 AM – 10 PM	65
		10 PM – 7 AM	55
	Business Zones BA, BB, BC	1 AM – 7 AM	55
		7 AM – 1 AM	75
	Industrial Zones IA, IB	1 AM – 7 AM	55
		7 AM – 1 AM	75
Town of Jamestown, RI4	Residential and open space	8 AM – 10 PM	70
	OS-I, OS-II, RR-200, RR-80, R-40, R-20, R-8	10 PM – 8 AM	60
	Business (neighborhood, waterfront and general) CL, CD, CQW, DC and Public	All	75
City of Newport, RI5	Residential and Noise Sensitive Area	7 AM – 10 PM	65
		10 PM – 7 AM	55
	Limited Business, General Business, Waterfront Business, and Commercial/Industrial	1 AM – 7 AM	55
		7 AM – 1 AM	75
	Public Water	1 AM – 7 AM	55
		7 AM – 1 AM	65
Town of Middletown, RI6	Residential	7 AM – 10 PM	65
		10 PM – 7 AM	55
	Business Zones BA, BB, BC	1 AM – 7 AM	55
		7 AM – 1 AM	75
	Industrial Zones IA, IB	1 AM – 7 AM	55
		7 AM – 1 AM	75
	All Locations (Wind Turbine Noise)	All times	30
Town of Little Compton, RI7	Residential	7 AM – 9 PM	55
		9 PM – 7 AM	50
Town of Westport, MA8	All	9 PM – 7 AM	60
Town of Dartmouth, MA9	No Quantitative Sound Level Limits	N/A	N/A
Town of Gosnold, MA10	N/A	N/A	N/A
Town of Aquinnah, MA10	N/A	N/A	N/A
Town of Chilmark, MA10	N/A	N/A	N/A
Town of West Tisbury, MA11	No Quantitative Sound Level Limits	N/A	N/A

Sources:

1. New Shoreham, Rhode Island Town Code Part II, Chapter 12, Noise, Accessed https://clerkshq.com/newshoreham-ri
2. South Kingston, Rhode Island Town Code, Part 3, Appendix A, Article 5, Section 507, February 13, 2019. Accessed https://library.municode.com/ri/south_kingstown/codes/code_of_ordinances?nodeId=PTIIICOOR_APXAZOOR_ART5SURE_S507STRECOINUS
3. Narragansett, Rhode Island Town Code, Chapter 22, Article III, Noise, September 18, 2019. Accessed https://library.municode.com/ri/narragansett/codes/code_of_ordinances?nodeId=PTIICOOR_CH22EN_ARTIIINO
4. Jamestown, Rhode Island Town Code, Chapter 22, Article III, Noise, January 23, 2006. Accessed http://www.jamestownri.gov/Home/ShowDocument?id=931
5. Newport, Rhode Island Municipal Code, Chapter 8.12, Noise Abatement, November 7, 2019. Accessed https://library.municode.com/ri/newport/codes/code_of_ordinances?nodeId=COOR_TIT8HESA_CH8.12NOAB
6. Middletown, Rhode Island Town Code, Title XIII, Chapter 130, Noise, August 5, 199. Accessed http://library.amlegal.com/nxt/gateway.dll/Rhode%20Island/middletown_ri/townofmiddletownrhodeislandcodeofordinan?f=templates$fn=default.htm$3.0$vid=amlegal:middletown_ri

7. Little Compton, Rhode Island Town Code, Chapter III, Section 3-1, Disturbing the Peace, January 7, 2016. Accessed https://clerkshq.com/littlecompton-ri
8. By-Laws and Regulations of the Town of Westport, Massachusetts Article XL, Noise Pollution Control. Accessed https://www.westport-ma.com/sites/westportma/files/pages/town_by-laws_2018_revised.pdf
9. Dartmouth, Massachusetts Town Code, part II, Chapter 250, Noise, August 15, 2001. Accessed https://ecode360.com/30909244
10. No Noise General or Zoning Bylaws or Ordinances
11. West Tisbury, Massachusetts Noise Bylaw. Accessed https://www.westtisbury-ma.gov/bylaws/pages/noise

3

Airborne Sound Analysis Methodology

The methodology used to assess potential effects of offshore airborne sound from the construction and operation of the RWF and RWEC includes 1) modeling future sound emissions from the construction and operation of the proposed Project, 2) assessing potential impact according to applicable criteria (see Section 2, Regulatory Context) and 3) evaluating the need for construction or operational airborne noise mitigation.

Operational and construction sound has been predicted using Cadna-A sound software. Cadna-A is an internationally-accepted sound prediction program that implements the International Standards Organization 9613-2 sound propagation standard. This model takes into account the sound emissions of equipment, the ground cover, terrain, and intervening objects such as buildings. For sound propagation from operations and construction of the WTGs and OSS, the ocean has been assumed to be flat and an acoustically hard, or reflective, surface (ground coefficient of zero) and land has been assumed to be acoustically absorptive (ground coefficient of 1). The 9613 standard assumes a downwind condition from the source to the receiver and is therefore a relatively conservative method of assessing sound propagation.

3.1 Operational

Operational sound generated by offshore components of the RWF and RWEC include operation of the proposed WTGs with two OSSs and nautical hazard prevention devices (foghorns).

3.1.1 Wind Turbine Generator Operations

The sound model assumes that all WTGs are operating continuously and concurrently at the typical maximum rated sound level. The PDE for operational noise of the WTGs is a sound power level of 115 to 120 dBA. This airborne sound assessment assumes the maximum design envelope footprint for the Project, which is a sound power level emission of 120 dBA per WTG. The sound emissions used in the analysis, presented in **Table 3.1-1**, are based on the overall and octave-band (i.e., 63 to 8000 Hz) A-weighted maximum sound power levels measured of the SG 8.0-167 DD model WTG in accordance with IEC 61400-11 edition 3 (2012) based on a hub height of 502 feet (153 m), a roughness length of 0.05 m, and wind speed of 22 mph (10 m/s) scaled to 120 dBA. These sound levels include mechanical and aerodynamic sources of the WTGs. Since WTGs typically radiate more sound in certain directions, the sound measurement test standard accounts for the maximum directional sound power level. Therefore, the sound emissions are worst-case as they relate to directivity.

Each OSS will house a high-voltage shunt reactor, medium voltage 66 kV and 275 kV switchgear, and an emergency diesel generator. The emergency diesel generator is typically the loudest source of sound on the OSS. The sound emissions of the generator depend primarily on the sound attenuation performance of the acoustic enclosure and exhaust silencer. Although the specific manufacturer, model, and sound attenuation specifications of the generator have not yet been determined, the sound emissions of the OSS are typically lower than the WTG.

Table 3.1-1 Wind Turbine Generator Noise Emissions

Equipment/ Model	Overall and Octave Band Sound Power Level (dBA)								
	Overall	63 Hz	125 Hz	250 Hz	500 Hz	1000 Hz	2000 Hz	4000 Hz	8000 Hz
SG 8.0-167 DD	120	103.3	108.9	111.6	112.3	113.5	114.1	110.2	98.4

Source: Siemens Gamema Renewable Energy A/S, SG 8.0-167 DD 153 Acoustic Emission (adjusted to maximum design envelope of 120 dBA)

3.1.2 Nautical Hazard Prevention Devices

Audible nautical hazard prevention devices (i.e., foghorns) will be installed on select WTGs along the outer perimeter of the wind farm area. The foghorns are designed to provide a 2.0-nautical mile (3.7-km) audible range and emit a 134 dB at 3 ft (1 m) tone at a frequency of 660 Hz. Code of Federal Regulations Title 33 § 67 specifies that foghorns are to be installed less than 150 ft (46 m) above mean sea level (MSL). The foghorn will be placed atop the transition deck at a maximum of 132 ft (40 m) above MSL and will be equipped with a fog detection device and allow for remote operation by passing vessel (i.e., non-continuous).

3.2 Construction

Offshore construction activities will include vessels and helicopters to transport materials and people to and from the Project site, impact pile driving for the monopole foundations.

3.2.1 Construction Vessels and Helicopters

Helicopters may be used for accessing and inspecting the WTGs and/or emergency transportation. Helicopters will also be used for additional crew transfers during foundation construction activities and the O&M phase. The helicopter route plan will be developed to meet industry guidelines and best practices in accordance with FAA guidance. These types of helicopter operations will generate sound similar to aircraft already operating in the airspace. Helicopter sound is generally focused in a cone-shaped space underneath the main rotor. The primary frequency content of airborne sound from helicopters is below 500 Hz.

Several types of vessels will be used during construction activities, such as a floating barge, towing tug, material barge, anchor handling tug, rock dumping vessel, crew transport vessel, feeder barge, and bunkering vessel. For each vessel type the route plan for the vessel operation area will be developed to meet industry guidelines and best practices in accordance with International Chamber of Shipping guidance. These types of vessels will generate sound similar to vessels already operating in the waterways. The United States Coast Guard has recommendations (USCG, 1982) for addressing noise on all commercial vessels inspected by the Coast Guard except for Mobile Offshore Drilling Units. These recommendations address the need for protecting crewmembers from harm and providing safe occupational noise conditions, but airborne noise from vessels is typically not a significant concern for persons onshore. Installation of the offshore export cable will progress at approximately 200 to 800 meters per hour, so vessels would not be near a particular onshore area for an extended period of time and no significant noise effects are anticipated from airborne vessel noise.

3.2.2 Impact Pile Driving for WTGs and OSS Foundations

Construction of the RWF would include monopile foundations for the WTGs and monopile or jacket foundations for the OSSs. Monopiles, hollow steel cylinders, for the WTGs would be up to 12 m in diameter and would be driven into the seabed 30 to 60 m using a hammer that generates up to 4000 kJ of energy. Installation of each pile would include a 20-minute soft start where lower hammer energy is used and then would be followed by up to 12 hours of piling per monopile with an average duration of 1 to 4 hours.

As shown in **Table 3.1-2**, the overall and octave-band (i.e. 63 to 8000 Hz) A-weighted sound power level emission of the pile driver is estimated to be up to 137 dBA based on typical reference data for impact pile driving (Renterghem, 2014; FTA, 2018; Abbot, 2004). Sound from pile driving has been evaluated based on the individual WTG foundation which is located closest to shore in Aquinnah, Massachusetts.

Table 3.1-2 Impact Pile Driving Airborne Sound Emissions

Equipment/ Type	Overall and Octave Band Sound Power Level (dBA)								
	Overall	63 Hz	125 Hz	250 Hz	500 Hz	1000 Hz	2000 Hz	4000 Hz	8000 Hz
Impact Hammer (4000 KJ)	137	96	107	112	119	136	108	100	90

Source: VHB, 2020

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4

Affected Environment

This section presents the affected environment for the offshore sound assessment including identifying NSRs.

4.1 Study Area

The proposed RWF Project would be approximately 15 miles west of the Town of New Shoreham, RI (Block Island) and 15 to 20 miles south of several other coastal towns in Rhode Island including South Kingston, Narragansett, Jamestown, Newport, Middletown, and Little Compton. The proposed RWF Project would be approximately 12 miles east/southeast of Martha's Vineyard, MA and 13 to 16 miles south of other coastal towns in Massachusetts including Westport, Dartmouth, and Gosnold. Noise Sensitive Receptors (NSRs) in the study area for offshore airborne sound includes the nearest shorelines of the municipalities shown in **Table 4.1-1**.

Existing ambient sound levels have been estimated using methods originally developed by the EPA and outlined by the United States Federal Transit Administration (FTA, 2018) based on population density and time of day. These ambient sound level estimates are relatively conservative in that they tend to underestimate ambient levels. This is a conservative approach since there can be a greater potential for noise effects from new sources of sound in areas that are quieter. Ambient sound levels range from 25 to 45 dBA during the night and 35 to 55 dBA during the day. For the quietest coastal areas with population densities less than 100 people per square mile, the estimated daytime sound levels of 35 dBA (Leq) and nighttime sound levels of 25 dBA (Leq).

Table 4.1-1 Estimated Existing Ambient Sound Levels

Location	Population Density (people/square mile) [A]	Existing Ambient Daytime Sound Level (Leq, dBA)	Existing Ambient Nighttime Sound Level (Leq, dBA)
Town of New Shoreham, RI	231	40	30
Town of South Kingstown, RI	537	45	35
Town of Narragansett, RI	1,125	50	40
Town of Jamestown, RI	557	45	35
City of Newport, RI	3,211	55	45
Town of Middletown, RI	1,100	50	40
Town of Little Compton, RI	167	40	30
Town of Westport, MA	310	45	35
Town of Dartmouth, MA	559	45	35
Town of Gosnold, MA	6	35	25
Town of Aquinnah, MA	56	35	25
Town of Chilmark, MA	46	35	25
Town of West Tisbury, MA	110	40	30

Source: VHB, 2020.
A: U.S. census data, 2010.

5

Environmental Consequences and Mitigation

This section presents the results of the noise impact assessment for the operation and construction of the Project.

5.1 Operational Sound Impact Assessment

5.1.1 Wind Turbine Generators

As described in Section 3.0, sound from the operation of the WTGs has been predicted using Cadna-A sound prediction software. As shown in **Figure 5.1-1** and **Table 5.1-1**, sound levels at the shorelines would be 25 dBA or less, which is below daytime ambient sound levels and typically below nighttime ambient sound levels except for locations with particularly low population densities (i.e., Towns of Gosnold, Aquinnah, and Chilmark) where sound levels from WTG operations may be up to two decibels above ambient conditions.

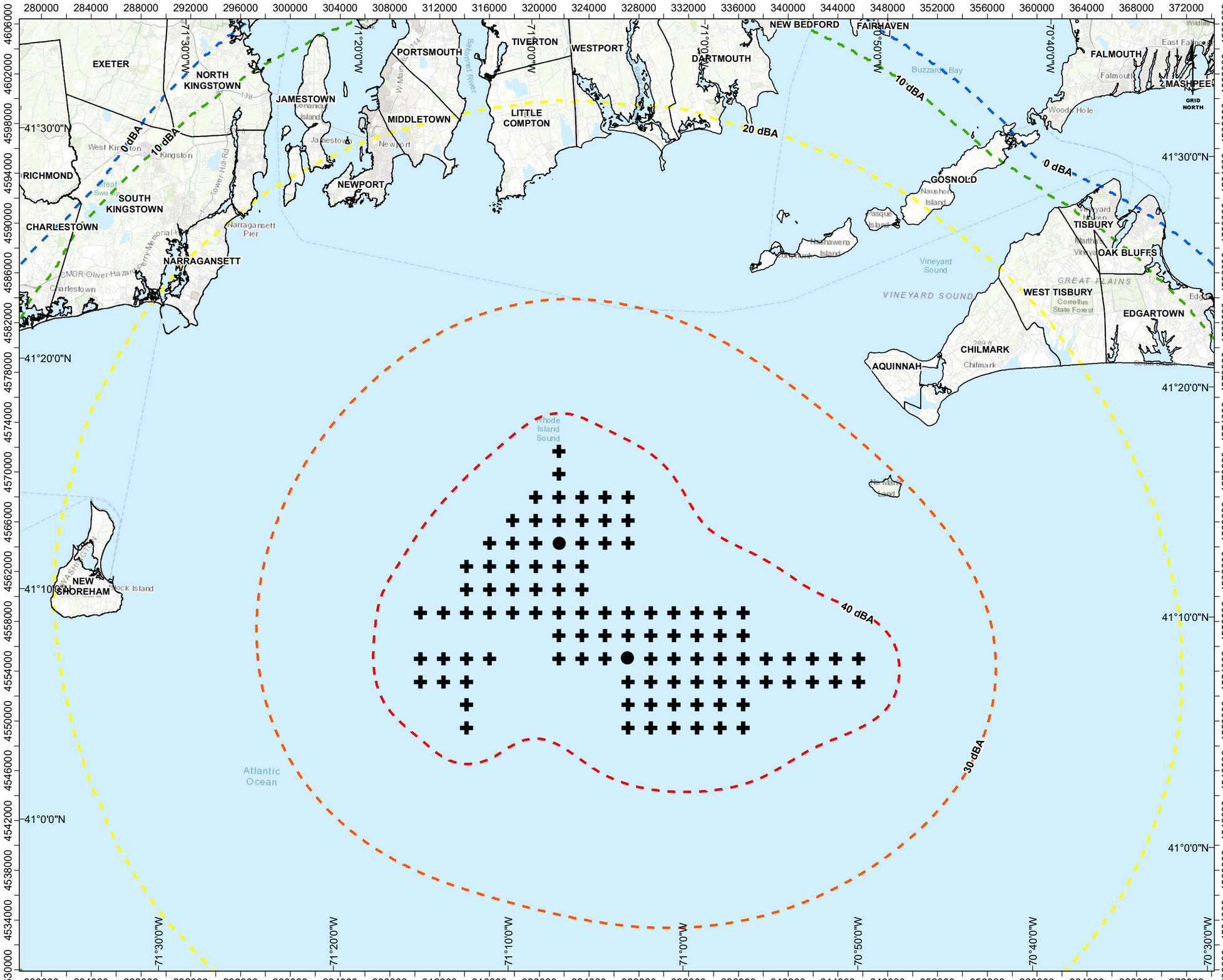
Sound levels from the operation of the WTGs would be 27.3 dBA or less at all shoreline locations. The highest sound level from the operation of the WTGs would be at the shoreline in Aquinnah, Massachusetts. The potential increase in sound level would be 4 dBA or less at during the nighttime at all locations, which would be substantially below the MassDEP noise criteria of no more than a 10-dBA increase. Sound levels would also be below the 30-dBA limit for wind turbines in the Town of Middletown, Rhode Island.

These sound levels are well below the EPA noise guideline and all local noise ordinances. Therefore, the operation of the WTGs would comply with all federal, state, and local noise regulations and there is no need for measures to avoid, minimize or mitigate operational noise.

Table 5.1-1 Offshore Wind Turbines: Operational Noise

Location	Existing Ambient Sound Level (Leq, dBA)		WTG Operational Sound Level (dBA)	Future Sound Level (Leq, dBA)		Sound Level Increase (Leq, dBA)	
	Daytime	Nighttime		Daytime	Nighttime	Daytime	Nighttime
Town of New Shoreham, RI	40	30	23.0	40.1	30.8	0.1	0.8
Town of South Kingstown, RI	45	35	19.2	45.0	35.1	0.0	0.1
Town of Narragansett, RI	50	40	21.9	50.0	40.1	0.0	0.1
Town of Jamestown, RI	45	35	20.7	45.0	35.2	0.0	0.2
City of Newport, RI	55	45	22.8	55.0	45.0	0.0	0.0
Town of Middletown, RI	50	40	22.9	50.0	40.1	0.0	0.1
Town of Little Compton, RI	40	30	24.5	40.1	31.1	0.1	1.1
Town of Westport, MA	45	35	22.3	45.0	35.2	0.0	0.2
Town of Dartmouth, MA	45	35	20.9	45.0	35.2	0.0	0.2
Town of Gosnold, MA	35	25	26.3	35.5	28.7	0.5	3.7
Town of Aquinnah, MA	35	25	27.3	35.7	29.3	0.7	4.3
Town of Chilmark, MA	35	25	27.2	35.7	29.2	0.7	4.2
Town of West Tisbury, MA	40	30	20.6	40.0	30.5	0.0	0.5

Source: VHB, 2020



Revolution Wind

In-Air Sound Study Results

Offshore Pile Driving

Figure 5.1-1
Offshore Wind Turbine Operational Airborne Sound Contours

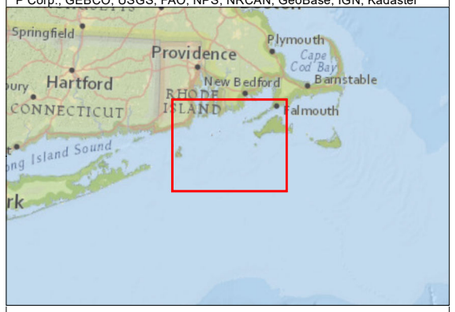
Sound Level Contours

- 0 dBA
- 10 dBA
- 20 dBA
- 30 dBA
- 40 dBA

Turbine

Offshore Substation

Anchorage, Environmental: Fugro
Shellgish Areas: MDMR
Service Layer Credits: Sources: Esri, HERE, Garmin, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster



Reference system: NAD83 (2011)
Projection: UTM Zone 19N

0 3300 6600 9900 Meters

0 10,000 20,000 Feet

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5.1.2 Nautical Hazard Warning Devices

Operational sound has been evaluated for audible nautical hazard prevention devices (i.e. foghorns) that would be installed on 14 of the WTGs at a maximum height of 132 feet above MSL (DNV GL, 2019). The assessment includes a condition where all foghorns would be sounded simultaneously as well as four conditions where an individual foghorn located on the eastern, southern, western, and northern ends of the WTGs would be sounded The foghorns would each generate a sound level of 134 dB at 3 feet at a frequency of 660 Hz to provide audible warning at a distance of 2.0 nautical miles. As shown in **Figure 5.1-2** and **Table 5.1-2**, the maximum sound level at shorelines surrounding the WTGs would be 15.1 dBA or less at all shoreline locations if all foghorns were sounded together. The highest received sound level would be 15.1 dBA at the Town of Chilmark, Massachusetts, which would be substantially lower than existing ambient conditions. This sound level would be substantially lower than the nighttime ambient sound level of 25 dBA (Leq) and would most likely not be audible. Future sound levels would increase 0.4 dBA or less at all shoreline locations. As shown in **Table 5.1-3** and **Figures 5.1-3** to **5.1-6**, the highest received sound level from an individual foghorn sounding would be 12.1 dBA for the easternmost foghorn.

These sound levels are well below the EPA noise guideline and all local noise ordinances. Therefore, the use of foghorns would comply with all federal, state, and local noise regulations and there is no need for measures to avoid, minimize or mitigate operational noise.

Table 5.1-2 Offshore Wind Turbines: Audible Nautical Hazard Warning (All Devices)

	Existing Ambient Sound Level (Leq, dBA)		WTG Operational Sound	Future Sound Level (Leq, dBA)		Sound Level Increase (Leq, dBA)	
Location	Daytime	Nighttime	Level (dBA)	Daytime	Nighttime	Daytime	Nighttime
Town of New Shoreham, RI	40	30	5	40.0	30.0	0.0	0.0
Town of South Kingstown, RI	45	35	< 0	45.0	35.0	0.0	0.0
Town of Narragansett, RI	50	40	< 0	50.0	40.0	0.0	0.0
Town of Jamestown, RI	45	35	< 0	45.0	35.0	0.0	0.0
City of Newport, RI	55	45	1.1	55.0	45.0	0.0	0.0
Town of Middletown, RI	50	40	2.6	50.0	40.0	0.0	0.0
Town of Little Compton, RI	40	30	9.6	40.0	30.0	0.0	0.0
Town of Westport, MA	45	35	1.4	45.0	35.0	0.0	0.0
Town of Dartmouth, MA	45	35	< 0	45.0	35.0	0.0	0.0
Town of Gosnold, MA	35	25	11.8	35.0	25.2	0.0	0.2
Town of Aquinnah, MA	35	25	13.5	35.0	25.3	0.0	0.3
Town of Chilmark, MA	35	25	15.1	35.0	25.4	0.0	0.4
Town of West Tisbury, MA	40	30	< 0	40.0	30.0	0.0	0.0

Source: VHB, 2020.

Table 5.1-3 Offshore Wind Turbines: Audible Nautical Hazard Warning (Individual Devices)

Individual Foghorn Location	Closest Municipality	Existing Ambient Sound Level (Leq, dBA)		WTG Operational Sound Level (dBA)	Future Sound Level (Leq, dBA)		Sound Level Increase (Leq, dBA)	
		Daytime	Nighttime		Daytime	Nighttime	Daytime	Nighttime
East	Town of Chillmark, RI	35	25	12.1	35.0	25.2	0	0.2
North	Town of Little Compton, RI	40	30	9.2	40.0	30.0	0	0
West	Town of New Shoreham, RI	40	30	1.7	40.0	30.0	0	0
South	Town of Aquinnah, RI	35	25	< 0	35.0	25.0	0	0

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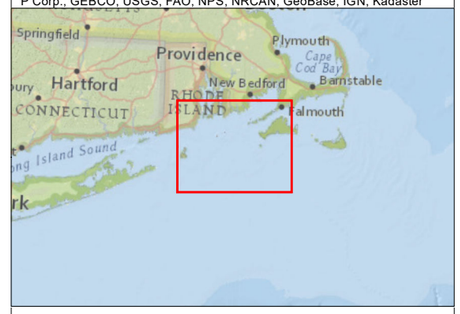
In-Air Sound Study Results
Emergency Signaling

Figure 5.1-2
Audible Nautical Hazard Warning (All Devices) Airborne Sound Contours

Sound Level Contours
- 0 dBA
- 10 dBA
- 20 dBA
- 30 dBA
- 40 dBA
- 50 dBA
- Foghorn
- Turbine
- Offshore Substation

Anchorage, Environmental: Fugro
Shellgish Areas: MDMR
Service Layer Credits: Sources: Esri, HERE, Garmin, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster



Reference system: NAD83 (2011)
Projection: UTM Zone 19N

0 3300 6600 9900 Meters

0 10,000 20,000 Feet

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In-Air Sound Study Results
Emergency Signaling

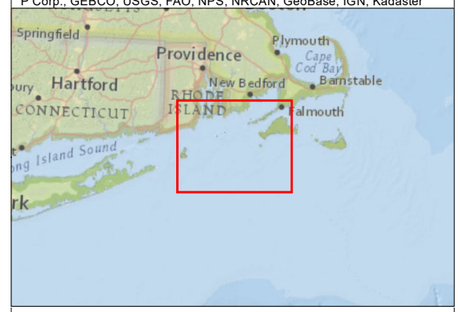
Figure 5.1-3
Audible Nautical Hazard Warning (Eastern Device) Airborne Sound Contours

Sound Level Contours

- 0 dBA
- 10 dBA
- 20 dBA
- 30 dBA
- 40 dBA
- 50 dBA

- Foghorn
- Turbine
- Offshore Substation

Anchorage, Environmental: Fugro
Shellgish Areas: MDMR
Service Layer Credits: Sources: Esri, HERE, Garmin, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster



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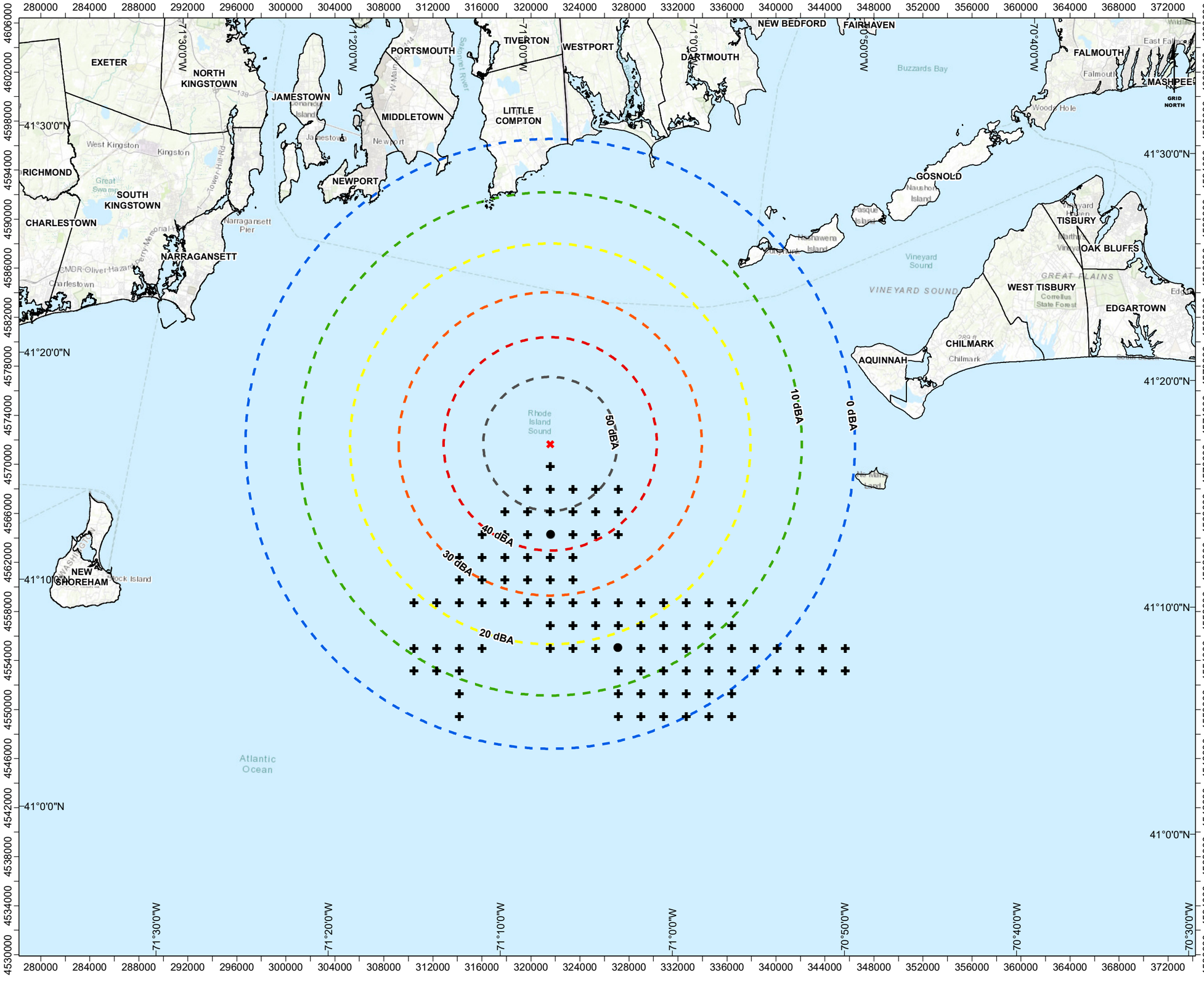

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In-Air Sound Study Results

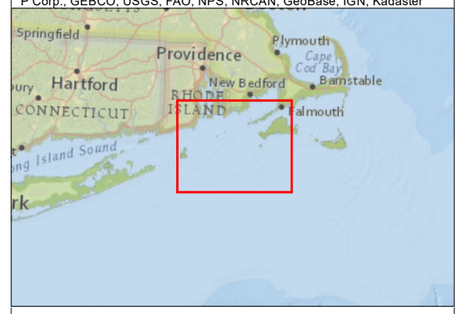
Emergency Signaling

Figure 5.1-4
Audible Nautical Hazard Warning (Northern Device) Airborne Sound Contours

Sound Level Contours

- 0 dBA
- 10 dBA
- 20 dBA
- 30 dBA
- 40 dBA
- 50 dBA
- Foghorn
- Turbine
- Offshore Substation

Anchorage, Environmental: Fugro
Shellgish Areas: MDMR
Service Layer Credits: Sources: Esri, HERE, Garmin, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster



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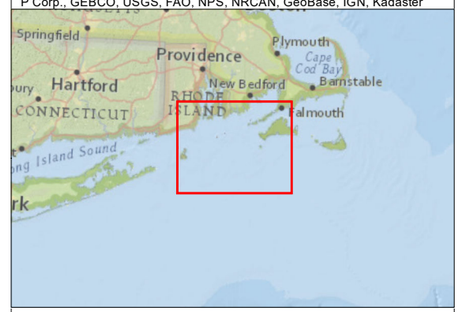
In-Air Sound Study Results
Emergency Signaling

Figure 5.1-5
Audible Nautical Hazard Warning (Western Device) Airborne Sound Contours

Sound Level Contours

- 0 dBA
- 10 dBA
- 20 dBA
- 30 dBA
- 40 dBA
- 50 dBA
- Foghorn
- Turbine
- Offshore Substation

Anchorage, Environmental: Fugro
Shellgish Areas: MDMR
Service Layer Credits: Sources: Esri, HERE, Garmin, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster



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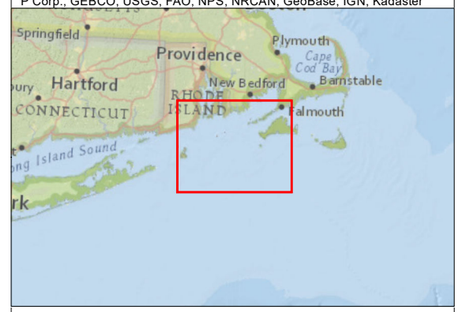
In-Air Sound Study Results
Emergency Signaling

Figure 5.1-6
Audible Nautical Hazard Warning (Souuthern Device) Airborne Sound Contours

Sound Level Contours

- 0 dBA
- 10 dBA
- 20 dBA
- 30 dBA
- 40 dBA
- 50 dBA
- Foghorn
- Turbine
- Offshore Substation

Anchorage, Environmental: Fugro
Shellgish Areas: MDMR
Service Layer Credits: Sources: Esri, HERE, Garmin, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster



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5.2 Construction Sound Impact Assessment

Impact pile driving of WTGs and OSS foundations has been evaluated for construction of the WTG closest to the shorelines assuming one pile driving operation would occur at a time. The analysis includes pile driving operations at the eastern, northern, western, and southern ends of the WTGs. As shown in **Figures 5.2-1** to **5.2-4** and **Table 5.2-1**, the maximum sound level from the pile driving would be 11.2 dBA at the shoreline of Chilmark, Massachusetts, which is substantially lower than existing ambient sound levels. At these low levels, sound from the pile driving activities would likely not be audible at the shorelines. There are no applicable federal, state, or local quantitative construction noise limits. Therefore, there would be no impact associated with offshore pile driving activities.

Table 5.2-1 Construction Sound from Pile Driving WTG Foundations

	Pile Driving Sound Level (dBA)			
Location	East	North	West	South
Town of New Shoreham, Rhode Island	< 0	1.0	7.9	< 0
Town of South Kingstown, Rhode Island	< 0	1.4	2.5	< 0
Town of Narragansett, Rhode Island	< 0	4.0	4.8	< 0
Town of Jamestown, Rhode Island	< 0	4.6	2.2	< 0
City of Newport, Rhode Island	< 0	7.6	2.9	< 0
Town of Middletown, Rhode Island	< 0	8.1	1.9	< 0
Town of Little Compton, Rhode Island	< 0	10.2	2.4	< 0
Town of Westport, Massachusetts	< 0	7.6	< 0	< 0
Town of Dartmouth, Massachusetts	< 0	5.7	< 0	< 0
Town of Gosnold, Massachusetts	3.2	9.9	0.5	0.6
Town of Aquinnah, Massachusetts	10.2	5.6	< 0	2.3
Town of Chilmark, Massachusetts	11.2	4.4	< 0	2.2
Town of West Tisbury, Massachusetts	4.9	< 0	< 0	< 0

Source: VHB, 2020.

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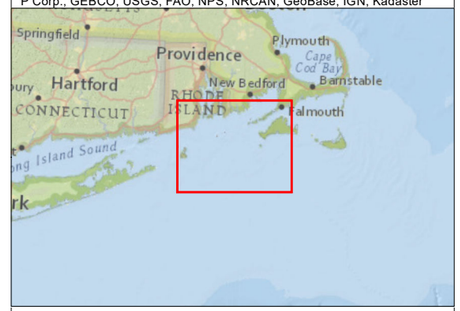
Revolution Wind
In-Air Sound Study Results
Offshore Pile Driving

Figure 5.2-1
Offshore Pile Driving (East)
Airborne Sound Contours

Sound Level Contours
- 0 dBA
- 10 dBA
- 20 dBA
- 30 dBA
- 40 dBA
- 50 dBA

Monopole Pile Driving
Turbine
Offshore Substation

Anchorage, Environmental: Fugro
Shellgish Areas: MDMR
Service Layer Credits: Sources: Esri, HERE, Garmin, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster



Reference system: NAD83 (2011)
Projection: UTM Zone 19N

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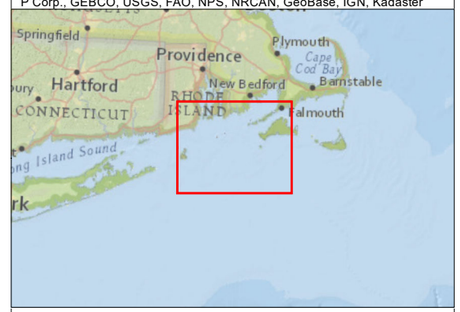
In-Air Sound Study Results
Offshore Pile Driving

Figure 5.2-2
Offshore Pile Driving (North)
Airborne Sound Contours

Sound Level Contours
- 0 dBA
- 10 dBA
- 20 dBA
- 30 dBA
- 40 dBA
- 50 dBA

Monopole Pile Driving
Turbine
Offshore Substation

Anchorage, Environmental: Fugro
Shellgish Areas: MDMR
Service Layer Credits: Sources: Esri, HERE, Garmin, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster



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Date: 05/19/2020
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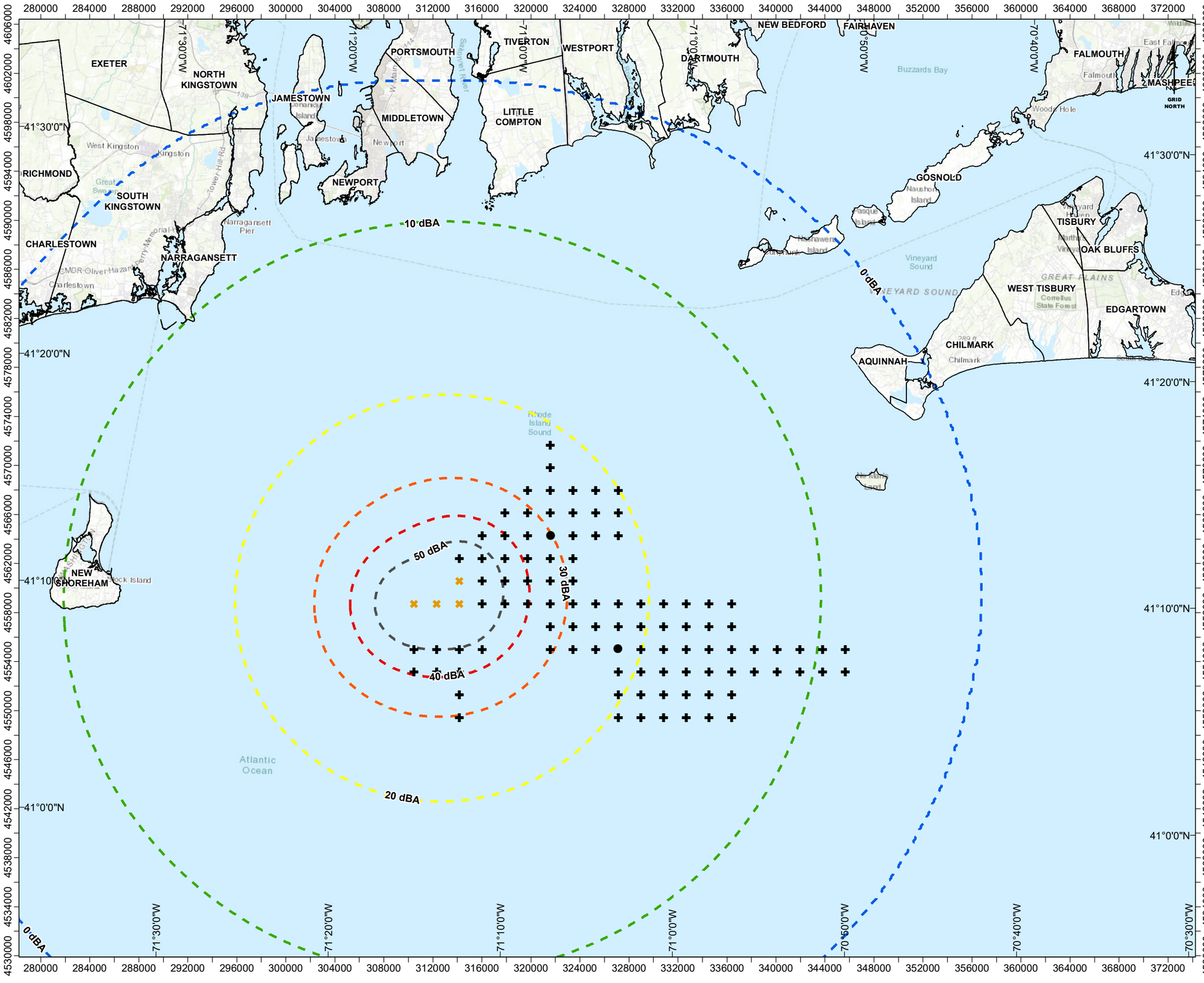


Revolution Wind

In-Air Sound Study Results

Offshore Pile Driving

Figure 5.2-3
Offshore Pile Driving (West)
Airborne Sound Contours

Sound Level Contours

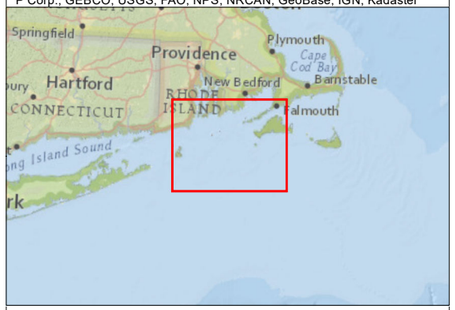
- 0 dBA
- 10 dBA
- 20 dBA
- 30 dBA
- 40 dBA
- 50 dBA

Monopole Pile Driving

Turbine

Offshore Substation

Anchorage, Environmental: Fugro
Shellgish Areas: MDMR
Service Layer Credits: Sources: Esri, HERE, Garmin, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster



Reference system: NAD83 (2011)
Projection: UTM Zone 19N

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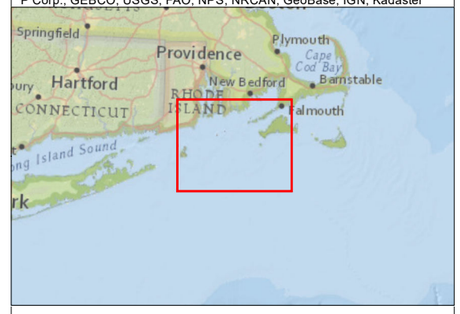
Revolution Wind
In-Air Sound Study Results
Offshore Pile Driving

Figure 5.2-4
Offshore Pile Driving (South)
Airborne Sound Contours

Sound Level Contours
- 0 dBA
- 10 dBA
- 20 dBA
- 30 dBA
- 40 dBA
- 50 dBA

Monopole Pile Driving
Turbine
Offshore Substation

Anchorage, Environmental: Fugro
Shellgish Areas: MDMR
Service Layer Credits: Sources: Esri, HERE, Garmin, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster



Reference system: NAD83 (2011)
Projection: UTM Zone 19N

0 3300 6600 9900 Meters

0 10,000 20,000 Feet

Date: 05/19/2020
Document no:

Created by: D. WHITE
Checked by: S. MOBERG
Approved by: STEPW

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5.3 Avoidance, Minimization and Mitigation

As described in Section 5, Environmental Consequences and Mitigation, there would be no operational or construction-period airborne noise impact due to offshore components of the Project. Therefore, there is no requirement for measures to avoid, minimize, or mitigate construction or operational offshore airborne noise.

5.4 Summary of Impacts

Sound from the operation of the WTGs would be 27.3 dBA or less and operation of the audible nautical hazard prevention devices would be 15.1 dBA or less at the nearest shorelines (from all foghorns sounding together) and 12.1 dBA or less from an individual foghorn. Operational sound from the Project would comply with relevant federal, state, and local noise standards.

Construction sound from pile driving would be 11.2 dBA or less at the nearest shorelines and would comply with relevant federal, state, and local noise standards.

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