APPENDIX E2

Assessment of Resources with Minor (or Less) Impact Determinations

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Assessment of Resources with Minor Impact Determinations

This appendix provides an assessment of resources with minor or lower incremental impacts from implementation of the Proposed Action and other considered action alternatives. Because these sections were originally part of Chapter 3 of the Revolution Wind Farm and Revolution Wind Export Cable Project environmental impact statement (EIS), chapter and section naming and numbering were maintained for simplicity. All abbreviations and references for these sections are provided in the main EIS and Appendix B, respectively.

3.4 Air Quality

3.4.1 Description of the Affected Environment and Environmental Consequences of the No Action Alternative for Air Quality

Geographic analysis area: The spatial scale for analysis of potential effects to air quality encompasses 1) the airshed within 25 miles of the estimate Project center (corresponding to the OCS Lease Area) and 2) the airshed within 15.5 miles of onshore construction areas and ports that may be used for the Project. These two areas collectively make up the air quality geographic analysis area (GAA) (Figure 3.4-1) (see COP Figure 4.2.1-1). The air quality GAA encompasses the region subject to U.S. Environmental Protection Agency (EPA) review as part of an OCS permit for the Project under the Clean Air Act (CAA) and provides a reasonable buffer for the limited Project vessel and equipment emissions anticipated to occur within on-land construction areas and mustering port(s) outside of the OCS air permit area during proposed construction activities.

For the purposes of this analysis, the existing air quality conditions for each county within the GAA were evaluated. These counties comprise Providence and Washington Counties in Rhode Island, Suffolk and Kings Counties in New York, New London County in Connecticut, Gloucester County in New Jersey, Bristol and Dukes Counties in Massachusetts, Norfolk City in Virginia, and Baltimore County in Maryland.

Affected environment: The scope of the affected environment for the assessment of potential Project-related emissions and impacts to ambient air quality encompasses offshore areas and those states and counties where Project activities could occur. Project construction and O&M activities could use several regional existing port facilities as discussed in COP Section 3.3.10.1 and COP Table 3.3.10-1.

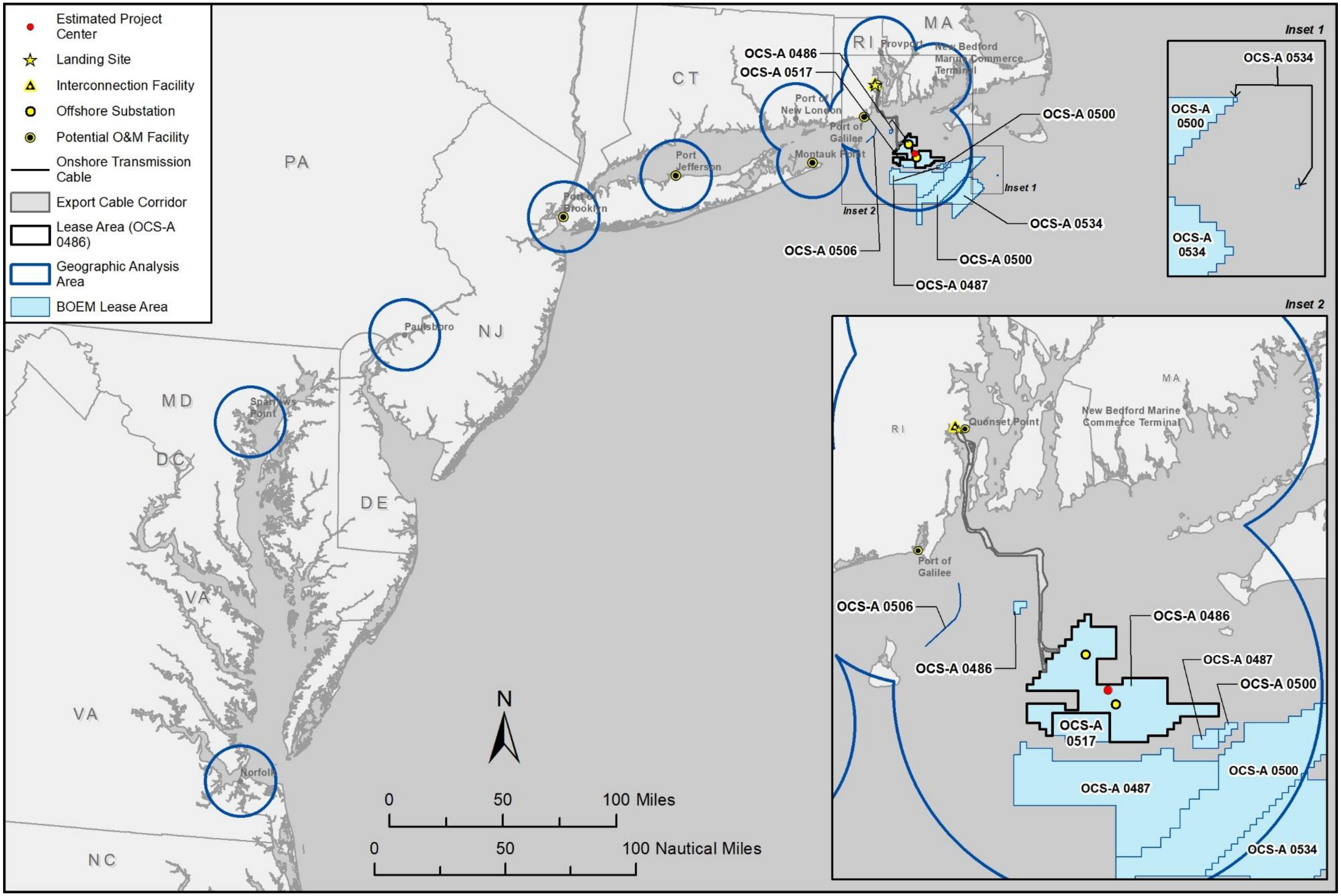

Figure 3.4-1. Geographic analysis area for air quality.

Air quality within a region is measured in comparison to the National Ambient Air Quality Standards (NAAQS), which are standards established by the EPA under the CAA (42 USC 7409) for criteria pollutants. The EPA has developed these standards to protect human health and welfare (primary standards) and provide public welfare protection, including protection against decreased visibility and damage to animals, crops, vegetation, and buildings (secondary standards). The criteria pollutants for which NAAQS have been established are carbon monoxide (CO), sulfur dioxide (SO_2), particulate matter 10 microns or less (PM_{10}), particulate matter 2.5 microns or less ($PM_{2.5}$), nitrogen dioxide (NO_2), ozone (O_3), and lead. The EPA uses design values to designate and classify nonattainment areas. A design value is a statistic that describes pollutant levels at a given location so they can be compared to the NAAQS. Nonattainment occurs if any criteria air pollutant concentration design value exceeds its NAAQS. The CAA amendments of 1990 established the nonattainment designations as marginal, moderate, and serious. If a region is designated as nonattainment for a NAAQS, the CAA requires the state to develop a state implementation plan (SIP). A SIP provides for the implementation, maintenance, and enforcement of the NAAQS, and includes emission limitation and control measures to attain and maintain the NAAQS. The CAA also prohibits federal agencies from approving any activity that does not conform to a SIP, and this prohibition applies only with respect to nonattainment or maintenance areas (i.e., areas that were previously nonattainment and for which a maintenance plan is required). Conformity to a SIP means conformity to a SIP's purpose of reducing the severity and number of violations of the NAAQS to achieve attainment of such standards. The activities for which BOEM has authority are outside of any nonattainment or maintenance area, and BOEM lacks any continuing program responsibility over activities potentially within any nonattainment area. Therefore BOEM's approval of the COP is not subject to the requirement to show conformity.

The areas of attainment for criterial pollutants within the GAA reported by the EPA (2021a) are in Table 3.4-1.

Table 3.4-1. U.S. Environmental Protection Agency Areas of Attainment for Criteria Pollutants

Location	EPA Reporting
Rhode Island, including all counties	Currently in attainment for all criteria pollutants.
Norfolk City, Virginia	Currently in attainment for all criteria pollutants.
Bristol County, Massachusetts	Currently in attainment for all criteria pollutants, but Dukes County is currently in marginal nonattainment for the 2008 8-hour O_3 standard.
Suffolk and Kings Counties, New York	Currently in serious nonattainment for the 2008 8-hour O^3 standard, moderate nonattainment for the 2015 8-hour O^3 standard, and in maintenance for the 2006 24-hour $PM_{2.5}$ standard.
Gloucester County, New Jersey	Currently in marginal nonattainment for both the 2008 8-hour O_3 standard and the 2015 8-hour O_3 standard and is also in maintenance for the 2006 24-hour $PM_{2.5}$ standard.
New London County, Connecticut	Currently in serious nonattainment for the 2008 8-hour O^3 standard and marginal nonattainment for the 2015 8-hour O_3 standard.
Baltimore County, Maryland	Currently in moderate nonattainment for the 2008 8-hour O^3 standard, marginal nonattainment for the 2015 8-hour O_3 standard, and nonattainment for the 2010 SO^2 standard.

Additional descriptions of air quality conditions for counties in nonattainment status are provided below.

Dukes County, Massachusetts, is an island community with a relatively low population density and little heavy industry. As is common in the northeastern region, non-road engines used for construction activities and on-road vehicle traffic are the main sources of nitrogen oxide (NO_X) in Dukes County (EPA 2020a). Vegetation sources and non-road engines are the primary volatile organic compound (VOC) emission sources in Dukes County. VOC and NO_X are precursor pollutants to the formation of O_3. Although the EPA currently classifies Dukes County as being in marginal nonattainment for the 2008 8-hour O_3 standard, ambient air quality monitors in Dukes County reported a steady decrease in O_3 levels from 2012 to 2015 (EPA 2021b). The EPA also recently (August 2018) designated Dukes County in attainment for the more stringent 2015 8-hour O_3 standard of 70.0 parts per billion (ppb) based on the 2014–2016 O_3 design value of 64.3 ppb (EPA 2021b). Recently, Dukes County reported an O_3 design value of 70.0 ppb for the 2016–2018 time period, 71.0 ppb for the 2017–2019 time period, and 66.0 ppb for the 2018–2020 time period (EPA 2021b).

Suffolk and Kings Counties, New York, have a high population density and Suffolk County sees the highest amount of commuter miles traveled in the New York metro area (EPA 2017). Suffolk County reported a steady decrease in O_3 concentration levels from 2017 to 2020 (EPA 2021b). The O_3 design value based on observations at the Riverhead air monitor in Suffolk County was 76.7 ppb during the 2015–2017 time period, 75.3 ppb for the 2016–2018 time period, 72.0 ppb for the 2017–2019 time period, and 70.0 ppb for the 2018– 2020 time period (EPA 2021b). There is no O_3 air monitor within Kings County. The nearby air monitor in Queens County reported a decrease in O_3 concentration levels from 2018 to 2020. The O_3 design value based on observations at the Queens College air monitor in Queens County was 74.0 during the 2015–2017 time period, 74.0 ppb for the 2016–2018 time period, 74.0 ppb for the 2017–2019 time period, and 70.0 ppb for the 2018–2020 time period (EPA 2021b). Thus, the EPA currently classifies Kings and Suffolk Counties as being in serious nonattainment for 8-hour O_3 according to the 2008 standard and in moderate nonattainment for the 2015 standard. Both counties are also in maintenance for the 2006 24-hour $PM_{2.5}$ standard. The EPA reports that on-road vehicles are the primary source of NO_X emissions emitted within Kings and Suffolk Counties; non-road engines are the second-largest source. Vegetation sources, solvent use in industry, off-highway engines, and on-road vehicles provide the most VOC emissions emitted within Kings and Suffolk Counties (EPA 2020a).

Gloucester County, New Jersey, has a much lower population density than Suffolk and Kings Counties, New York. Air quality within Gloucester County is affected by nearby Philadelphia. NO_X emissions in Gloucester County are primarily from on-road vehicles, with fuel combustion for industrial purposes, electric generation, and other needs being the second-largest source. Storage and transport, vegetation, and solvent use are the primary sources of VOC emissions in Gloucester County (EPA 2020a). Although the EPA currently classifies Gloucester County as being in marginal nonattainment for the 2008 and 2015 8-hour O_3 standards, the ambient air quality monitor in Gloucester County reported a steady decrease in O_3 levels from 2018 to 2020 (EPA 2021b). Gloucester County reported an O_3 design value of 74.0 ppb for the 2015–2017 and 2016–2018 time periods, 72.0 ppb for the 2017–2019 time period, and 69.0 ppb for the 2018–2020 time period (EPA 2021b).

New London County, Connecticut, is a rural county with a low population density and small industrial bases. Neighboring metro areas outside this county heavily affect the air quality of the county in addition to regional sources. For this reason, changes to pollutant emissions by sources within the county have little impact on the overall air quality trends. NO_X emissions in New London County are primarily from on-road vehicles, with fuel combustion for industrial purposes, electric generation, and other needs being the second-largest source. Vegetation sources and solvent use are the primary sources of VOC emissions (EPA 2020a). Although the EPA currently classifies the county as being in serious nonattainment for the 2008 8-hour O_3 standard and marginal nonattainment for the 2015 8-hour O_3 standard, the ambient air quality monitor in the county reported a small decrease in O_3 levels from 2018 to 2020 (EPA 2021b). New London County reported an O_3 design value of 76.0 ppb for the 2015–2017 time period, 75.0 ppb for the 2016–2018 and the 2017–2019 time periods, and 73.0 ppb for the 2018–2020 time period (EPA 2021b).

Baltimore County, Maryland, has a population density three times greater than New London County, Connecticut. Although the EPA currently classifies Baltimore County as being in moderate nonattainment for the 2008 8-hour O_3 standard and marginal nonattainment for the 2015 8-hour O_3 standard, ambient air quality monitors in Baltimore County reported a steady decrease in O_3 levels from 2018 to 2020 (EPA 2021b). The O_3 design value based on observations at the Essex air monitor in Baltimore County was 73.0 ppb for the 2015–2017 and 2016–2018 time periods, 72.0 ppb for the 2017–2019 time period, and 69.0 ppb for the 2018–2020 time period (EPA 2021b). In Baltimore County, NO_X emissions are primarily from on-road vehicles, with fuel combustion for industrial purposes, electric generation, and other needs being the second-largest source. Vegetation, solvent use, and on-road vehicles are the main sources of VOC emissions (EPA 2020a). The EPA has also classified Baltimore County as being in nonattainment for the 2010 SO_2 standard, although the SO_2 air quality monitor in Baltimore County has reported a steady decline in SO_2 concentration levels since 2016 (EPA 2021b). Baltimore County reported an SO_2 design value of 13.0 ppb for the 2015–2017 time period, 11.0 ppb for the 2016–2018 time period, 10.0 ppb for the 2017–2019 time period, and 9.0 ppb for the 2018–2020 time period (EPA 2021b). The main source of SO_2 emissions in Baltimore County comes from fuel combustion for electric generation (EPA 2020a).

The Ozone Transport Region (OTR) was established by operation of law under CAA Section 184 and comprises the states of Connecticut, Delaware, Maine, Massachusetts, Maryland, New Hampshire, New Jersey, New York, Pennsylvania, Rhode Island, and Vermont; the District of Columbia; and the portion of Virginia that is within the Consolidated Metropolitan Statistical Areas that includes the District of Columbia. Congress established the OTR in the 1990 CAA amendments based on the recognition that the transport of ozone and ozone precursors throughout the region may render the states' attainment strategies interdependent. States within the OTR may have similar permitting requirements as ozone nonattainment areas.

Table 3.4-2 presents the total emission inventory in tons per year (tpy) for select regulated pollutants (i.e., CO, NOX, PM_{10}, $PM_{2.5}$, SO2, and VOC) in nonattainment counties in 2017.

Table 3.4-2. Nonattainment Counties, 2017 Emission Inventory for Regulated Pollutant (tpy)

County, State	CO	NO_X	PM_{10}	$PM_{2.5}$	SO_2	VOC
New London County, Connecticut	25,671.25	5,300.74	2,882.84	1,072.31	289.57	15,606.98
Dukes County, Massachusetts	6,395.82	989.64	407.96	135.99	13.07	2,740.63
Baltimore County, Maryland	71,702.20	10,661.44	12,184.54	3,207.24	1,041.34	16,919.12
Gloucester County, New Jersey	30,399.73	6,260.63	2,161.41	1,311.48	599.94	10,507.34
Kings County, New York	59,473.56	13,571.74	4,959.06	2,559.52	477.53	17,660.21
Suffolk County, New York	146,719.86	20,336.81	9,682.55	3,889.70	1,197.73	32,676.35

Source: EPA (2020a)

The CAA provides special air quality protection to national parks larger than 6,000 acres and national wilderness areas larger than 5,000 acres that were in existence before August 1977 (National Park Service 2020). These areas are referred to as Class I areas and are managed by the U.S. Forest Service (USFS), National Park Service (NPS), and U.S. Fish and Wildlife Service (USFWS). Designation as a Class I area allows only very small increments of new pollution above already existing air pollution levels. One of the purposes of the Prevention of Significant Deterioration permitting program under the CAA, is to preserve, protect, and enhance the air quality in national parks, national wilderness areas, national monuments, national seashores, and other areas of special national or regional natural, recreational, scenic, or historic value. Air quality related values (AQRVs) are used to determine whether these resources may be adversely affected by a change in air quality. Federal land managers AQRVs include visibility, vegetation, water quality, soils, and impacts to fish and wildlife. The potential harm from air pollution to these resources depends on quantity of emission, the type of air emission exposure, and the sensitivity of the resources. Current visibility conditions and trends in Class I areas are established via the IMPROVE (Interagency Monitoring of Protected Visual Environments) program. The nearest Class I areas to the Proposed Action are Lye Brook Wilderness, located approximately 155 miles northwest of the Lease Area, and Brigantine Wilderness, located approximately 190 miles southwest of the Lease Area. The Lye Brook Wilderness IMPROVE monitor is located on the ski slopes of Mount Snow approximately 9.5 miles southeast of the Lye Brook Wilderness Area boundary. The Brigantine Wilderness is made up of three separate areas; all three are part of the Edwin B. Forsythe National Wildlife Refuge. The Brigantine Wilderness IMPROVE monitor is located at the Edwin B. Forsythe National Wildlife Refuge Visitor Center, approximately 4 miles west and 4 miles south-southwest of the two closest Brigantine Wilderness Area boundaries. Visibility at both the Lye Brook Wilderness and Brigantine Wilderness Class I areas has been steadily improving since 2010 (Federal Land Manager Environmental Database 2021). No visibility or deposition modeling was conducted as part of this EIS analysis because both Lye Brook Wilderness and Brigantine Wilderness Class I areas are located more than 155 miles away from the Lease Area. If further visibility modeling is required, it will be conducted during the OCS permitting process.

Climate Change: Climate change is a global issue that results from the increase in greenhouse gases (GHGs) in the atmosphere. An analysis of regional climate impacts prepared by the Fourth National

Climate Assessment (U.S. Global Change Research Program 2018) concludes that the rate of warming in the Northeast has markedly accelerated over the past few decades, with seasonal differences in temperature decreasing in recent years as winters have warmed three times faster than summers. Higher temperatures from the increase of GHGs in the atmosphere increase the number of heat events and extreme rain events that cause coastal flooding. The higher temperatures also extend the duration of the pollen season. Analysis of past records and future projections indicates an overall increase in regional temperatures, including near the Lease Area. The most recently available data on GHG emissions in the United States indicate that annual GHG emissions in 2019 were an estimated 6,558 million metric tons of carbon dioxide equivalents (CO2e) (EPA 2021c).

3.4.1.1 Future Offshore Wind Activities (without Proposed Action)

This section discloses potential air quality impacts associated with future offshore wind development. Analysis of impacts associated with ongoing activities and future non–offshore wind activities is provided in Appendix E1.

Air emissions and climate change: Under the No Action Alternative, assuming no other future offshore wind projects are developed, electric generation needs would continue to be met by fossil fuel–generating technologies, resulting in more air emissions than what would be expected should future offshore wind development occur. Specific impacts would depend on the type of fossil fuel used (natural gas, oil, coal), the technology and pollution control systems chosen, and the site-specific issues associated with individual electric generation facilities. However, the continued use of existing fossil fuel–combusting electric generation sources would result in annual emissions that could have been avoided by using non–fossil fuel energy sources. These emissions, presented in Table 3.4-3, were estimated using the EPA's Avoided Emissions and geneRation Tool (AVERT) version 3.1.1 for the New England region based on the design capacity of the offshore wind projects that would not be developed.

Table 3.4-3. Estimated Annual Avoided Emissions (tpy) for the Operation of Future Offshore Wind Projects within the Geographic Analysis Area

Limit	CO_2	NO_X	SO_2	$PM_{2.5}$	VOC	NH_3
Lower limit	23,850,536.17	3,913.91	1,656.71	683.25	444.27	616.16
Upper limit	33,414,814.35	5,480.48	2,313.53	956.94	622.17	862.57

Source: BOEM (2021); EPA (2020b)

Notes: Avoided emissions are presented in tons per year and were obtained using the EPA's AVERT (EPA 2020b). AVERT limits the maximum input generation capacity for the New York region to 1,300 MW, which, according to AVERT, is to limit any project from displacing more than approximately 30% of regional fossil generation in any hour. For each of the offshore wind projects within the GAA with a generation capacity greater than 1,300 MW, the avoided emissions were calculated via AVERT based on a 1,300-MW energy generation capacity. AVERT avoided emission values were then scaled up to represent the full energy generation capacity for offshore wind projects with a generation capacity greater than 1,300 MW. For example, an offshore wind project generating 2,600 MW would have twice the avoided emissions values calculated by AVERT for a 1,300-MW offshore wind project.

The lower limit represents the sum of the avoided emissions, as calculated by AVERT, for all of the various offshore wind projects within the GAA limited to a maximum energy generation capacity of 1,300 MW per project. The upper limit represents the sum of the avoided emissions for the same offshore wind projects based on their actual energy generation capacity, scaling up the avoided emission values for the projects with an energy generation capacity greater than 1,300 MW.

Assuming the development of other future wind development and other renewable energy sources, these sources would decrease emissions over the long term, likely reduce the need for traditional fossil fuel power generation in the region, and could result in improved air quality when compared to expected air quality without other future wind development and renewable energy sources. Adjacent states have also proposed emission-reduction targets and renewable goals that overlap the operations of the Project and that are aimed at reducing air emissions and shifting energy sources from traditional fossil fuel generation to cleaner sources of energy. These plans could further reduce, but would not eliminate, air emissions.

During construction, impacts from future wind development activities on air quality under the No Action Alternative would be temporary **minor** to **moderate** adverse, depending on the extent and duration of emissions. Primary emission sources would include increased vessel and air traffic, combustion emissions from construction equipment, and fugitive emissions.

Based on assumed construction schedules, offshore wind development would occur with overlapping construction schedules between 2022 to 2030. As shown in Table 3.4-4, construction of these projects in the GAA with sufficient details to estimate emissions would generate an estimated 25,208 tons of NO_X, 176 tons of SO_2, 781 tons of PM_{10}, and 1,904,101 tons of CO_2 over the 8-year construction period. For comparison purposes, according to the EPA's 2017 National Emissions Inventory, Suffolk County reported 8,122 tons of NO_X, 124 tons of SO_2, and 872 tons of PM_{10} from highway vehicles; 6,566 tons of NO_X, 34 tons of SO_2, and 537 tons of PM_{10} from off-highway vehicles; and 860 tons of NO_X, 421 tons of SO_2, and 146 tons of PM_{10} from electrical utilities' combustion of fuel (EPA 2020a). Similarly, future offshore wind project GHG emissions during construction would be negligible (1,904,101 tons of CO_2) as compared to aggregate global emissions, and these projects could beneficially contribute to a broader combination of actions to reduce future impacts from climate change over the long term. An analysis by Barthelmie and Pryor (2021) calculated that, depending on global trends in GHG emissions and the amount of wind energy expansion, development of wind energy could reduce predicted increases in global surface temperature by 0.3-0.8 degrees Celsius (°C) (0.5–1.4 degrees Fahrenheit [°F]) by 2100.

As shown in Table 3.4-5, the O&M of future offshore wind projects in the GAA would have a proportionally small contribution of long-term and intermittent emissions, including 1,212 tons of NO_X, 4 tons of SO_2, 33 tons of PM_{10}, and 111,535 tons of CO_2.

3.4.1.2 Conclusions

Under the No Action Alternative, BOEM would not approve the COP; Project construction and installation, O&M, and decommissioning would not occur; and potential impacts on air quality associated with the Project would not occur. However, ongoing and future activities would have continuing temporary to long-term impacts on air quality, primarily through construction-related air emissions.

BOEM anticipates that the impacts of ongoing activities, such as air emissions and GHGs, would be moderate adverse. In addition to ongoing activities, reasonably foreseeable activities other than offshore wind could also contribute to impacts on air quality. Reasonably foreseeable activities, other than offshore wind, that will increase air emissions and GHGs include construction and operation of new energy generation facilities to meet future power demands as transportation and heating become increasingly electrified. Although states are developing onshore renewable energy facilities (through their state energy plans) to the extent practicable to help meet future demand, these state plans also depend on the development of offshore wind. Therefore, under the No Action Alternative, to the extent that offshore wind is not developed, there would be a shortfall from planned renewable power generation, and nonrenewable sources would likely be needed to meet future demand. These facilities could include new natural gas–fired power plants or coal-fired, oil-fired, or clean coal–fired plants. BOEM anticipates that the impacts of reasonably foreseeable activities other than offshore wind would be **moderate** adverse. BOEM expects the combination of ongoing activities and reasonably foreseeable activities other than offshore wind to result in **moderate** adverse impacts on air quality, primarily driven by recent market and permitting trends indicating future electric generating units would most likely include natural gas–fired and oil-fired dual fuel facilities, a mix of natural gas, and dual fuel natural gas/oil.

Considering all the IPFs together, BOEM anticipates that the impacts associated with future offshore wind activities in the GAA combined with ongoing activities, reasonably foreseeable environmental trends, and reasonably foreseeable activities other than offshore wind would be **minor** to **moderate** adverse. Emissions generated from construction and decommissioning of the offshore wind projects would be the primary source of impacts to air quality. Other future offshore wind projects could also lead to reduced emissions from fossil fuel–combusting power generation facilities, resulting in **minor** to **moderate** beneficial impacts on air quality.

Table 3.4-4. Projected Construction Emissions (tons) for Carbon Dioxide and Regulated Pollutant for Projects in the Geographic Analysis Area from 2022 to 2030

Project	CO_2	NO_X	SO_2	CO	PM_{10}	$PM_{2.5}$	VOC
New England Wind, OCS-A 0534 and portion of OCS-A 0501 (Phase 1 [i.e., Park City Wind])	30,628	238	3	99	4	4	6
Sunrise, OCS-A 0487	637,986	5,876	6	2,441	108	108	138
South Fork, OCS-A 0517	97,026	1,451	33	284	49	47	59
New England Wind, OCS-A 0534 and portion of OCS-A 0501 (Phase 2 [i.e., Commonwealth Wind])	85,811	1,256	7	292	50	49	27
Remaining Massachusetts/Rhode Island Lease Area	1,052,650	16,388	127	3,686	569	547	401
Total	**1,904,101**	**25,208**	**176**	**6,802**	**781**	**755**	**630**

Source: BOEM (2021)

Table 3.4-5. Projected Operations and Maintenance Emissions (tons) for Carbon Dioxide and Regulated Pollutant for Projects in the Geographic Analysis Area from 2022 to 2030

Project	CO_2	NO_X	SO_2	CO	PM_{10}	$PM_{2.5}$	VOC
New England Wind, OCS-A 0534 and portion of OCS-A 0501 (Phase 1 [i.e., Park City Wind])	2,665	31	0.1	8	1	1	1
Sunrise, OCS-A 0487	64,145	590	1	246	11	11	14
South Fork, OCS-A 0517	18,894	281	2	58	10	10	6
New England Wind, OCS-A 0534 and portion of OCS-A 0501 (Phase 2 [i.e., Commonwealth Wind])	7,705	76	0.2	19	3	2	1
Remaining Massachusetts/Rhode Island Lease Area	18,126	234	1	60	8	8	7
Total	**111,535**	**1,212**	**4**	**390**	**33**	**32**	**29**

Source: BOEM (2021)

3.4.2 Environmental Consequences

3.4.2.1 Relevant Design Parameters, Impact-Producing Factors, and Potential Variances in Impacts

The Project design parameters that would influence the magnitude of impacts on air quality are listed in Table 3.4-6.

Table 3.4-6. Project Design Parameters

Design Parameter
Air emission ratings of construction equipment engines
Port selection and location of construction laydown areas
Choice of cable-laying locations and pathways
Choice of marine traffic routes to and from the Lease Area
Number of offshore substations
Soil characteristics at excavation sites
Emission control strategy for fugitive emissions due to excavation and hauling operations

Variability of the Project design as a result of the PDE includes the number of WTGs and their spacing within the Lease Area, spatial coverage of the overall Lease Area, and the construction schedule. A reduction (or increase) in the number of WTGs installed and their associated IACs would likely have an associated reduction (or increase) in associated vessel and equipment use and their generated air emissions. Additionally, variations in the planned cable layout and landfall locations would impact the magnitude and spatial extent of emissions. Appendix D provides additional information about the PDE.

See Appendix E1 for a summary of IPFs analyzed for air quality across all action alternatives. IPFs that are either not applicable to the resource or determined by BOEM to have a negligible effect are excluded from Chapter 3 and provided in Table E1-1 in Appendix E1. Offshore and onshore IPFs are addressed separately in the analysis if appropriate for the resource; not all IPFs have both an offshore and onshore component. Where feasible, calculations for specific alternative impacts are provided in Appendix E4 to facilitate reader comparison across alternatives.

Table 3.4-7 discloses IPF findings carried forward for analysis in this section. Each alternative analysis discussion consists of the construction and installation phase, the O&M phase, the decommissioning phase, and the cumulative analysis. If these analyses are not substantially different, then they are presented as one discussion.

A detailed analysis of the Proposed Action follows the table. Detailed analysis of other considered action alternatives is also provided below the table if analysis indicates that the alternative(s) would result in substantially different impacts than the Proposed Action.

The conclusion section for each alternative analysis provides additional rationale for this impact determination. The overall impact of any alternative would be **moderate** adverse because the overall effects would be notable, but the resource would recover completely from adverse impacts without mitigation or remedial action.

Table 3.4-7. Alternative Comparison Summary for Air Quality

Impact-Producing Factor	Alternative A (No Action Alternative)	Alternative B (Proposed Action) Up to 100 WTGs*	Alternative C (Habitat Alternative) 64 or 65 WTGs	Alternative D (Transit Alternative) 78 to 93 WTGs	Alternative E (Viewshed Alternative) 64 or 81 WTGs	Alternative F (Higher Capacity Turbine Alternative) 56 WTGs
Air emissions and climate change	**Offshore:** During construction, impacts from future wind development activities on air quality would be temporary and **minor** to **moderate** adverse, depending on the extent and duration of emissions. Primary emission sources would include increased vessel and air traffic, combustion emissions from construction equipment, and fugitive emissions. Future offshore wind projects could also beneficially contribute to a broader combination of actions to reduce future impacts from climate change over the long term.	**Offshore:** Project construction would have a limited duration, and most emissions would occur offshore. The only air emissions anticipated during O&M would result from crew and maintenance vessels and helicopters. Therefore, impacts on air quality near populated areas would be temporary **minor** adverse. Project O&M would also generate long-term **minor** beneficial impacts by providing energy to the region from a renewable resource and due to avoided health events. The overall cumulative impacts associated with the Proposed Action when combined with other past, present, and reasonably foreseeable activities would be **moderate** adverse, although regional air quality could be improved over the Project lifecycle when compared to the No Action Alternative.	**Offshore:** When compared to the maximum case for the Proposed Action, construction under Alternatives C through F could result in a decrease in Project-related emissions due to less trenching and/or vessel traffic to install a reduced number of WTGs and their associated IACs. In such cases, emissions from construction and installation would be less than the Proposed Action but still temporary **minor** adverse. Alternatives C through F could also result in reduced O&M emissions because fewer WTGs installed, when compared to the maximum case under the Proposed Action, would mean potentially reduced inspection time, fewer turbines needing regular maintenance, etc. Alternatives C through F would avoid similar amounts of emissions as the minimum and maximum avoided emission values for the Proposed Action presented in Table 3.4-12. During O&M, Alternatives C through F would also result in long-term minor beneficial impacts on regional air quality by substituting some existing fossil fuel sources with a renewable source, which would contribute to a long-term net decrease in emissions in the region. Therefore, overall impacts on air quality under Alternatives C through F would likely be **minor** adverse and long term **minor** beneficial. Alternatives C through F would result in impacts on air quality at quantities and durations similar to, or slightly reduced from, the Proposed Action. Although regional air quality could be improved when compared to the No Action Alternative, it would be too remote or speculative to conclude what that change would be. Given the marginal reduction, however, the cumulative impacts of Alternatives C through F on air quality when combined with past, present, and reasonably foreseeable activities would remain **moderate** adverse.			
	Onshore: Ongoing activities and reasonably foreseeable activities other than offshore wind would result in **moderate** adverse impacts on air quality, primarily driven by recent market and permitting trends indicating future electric generating units would most likely include natural gas–fired and oil-fired dual fuel facilities, a mix of natural gas, and dual fuel natural gas/oil.	**Onshore:** Air emissions generated by construction and O&M of the onshore facilities could have temporary **negligible** to **minor** adverse impacts on air quality. When combined with other onshore sources of air emissions, cumulative impacts on air quality from onshore Project activities would be long term **minor** adverse.	**Onshore:** Alternatives C through F would not impact onshore activities; therefore, construction and O&M impacts would be the same as those described for the Proposed Action: temporary, **negligible** to **minor** adverse. Cumulative impacts would also be the same as those described for the Proposed Action: long term **minor** adverse.			

* If the Proposed Action were to select an 11–12 MW turbine, then the total number of WTGs installed and impacts from associated air emissions would be similar or the same as those under Alternatives C through F.

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3.4.2.2 Alternative B: Impacts of the Proposed Action on Air Quality

In their *Air Emissions Calculations and Methodology* technical report, Tech Environmental (2021) conservatively assumed that construction of the Project would only take 1 year. For estimating potential transit emissions, 11 regional ports that could be used during construction and O&M were considered (Table 3.4-8).

Table 3.4-8. Regional Ports Considered

Port Name	Location
Port of Providence	Providence County, Rhode Island
Port of Davisville at Quonset Point	Washington County, Rhode Island
Port of Galilee	Washington County, Rhode Island
Port of Montauk	Suffolk County, New York
Port Jefferson	Suffolk County, New York
Port of Brooklyn	Kings County, New York
Port of New London	New London County, Connecticut
Paulsboro Marine Terminal	Gloucester County, New Jersey
New Bedford Marine Commerce Terminal	Bristol County, Massachusetts
Port of Norfolk	Norfolk City, Virginia
Sparrow’s Point	Baltimore County, Maryland

All ports except New York’s Port of Montauk, Port Jefferson, and Port of Brooklyn were used for estimating construction emissions. The three ports in New York and the Ports of Davisville at Quonset Point and Galilee in Rhode Island were used for estimating O&M emissions.

It was conservatively assumed that when there were multiple port options for a particular Project phase involving regular transit, the port used for the emission calculations was the one with the longest transit distance. In the cases where multiple ports were listed as potential ports for vessel activities, the emissions were conservatively allocated to all potential ports. This approach provides a very conservative estimate of potential emissions for each state.

O_3 emissions are not included in the air quality impact analyses presented herein. O_3 emissions cannot be easily quantified since O_3 formation is a byproduct of chemical reactions between VOC and NO_X caused by heat and sunlight and thus emissions of O_3 depend on local weather conditions.

3.4.2.2.1 Construction and Installation

Offshore Activities and Facilities

Air emissions and climate change: Table 3.4-9 presents a summary of the Project’s estimated offshore construction emissions emitted during a maximum-case scenario in which all construction activities would occur in a single year. Construction emissions occurring within 15.5 miles of on-land construction areas and port locations are compared to the emission inventories of the impacted counties.

Over the approximate 1-year construction period, Project air emissions from vessels, helicopters, generators, and fuel-burning equipment could have temporary, direct impacts on air quality. Estimated emissions for most pollutants occurring within 15.5 miles of on-land construction areas and port locations would represent a 16.0% or less temporary increase in air pollutants for counties within the GAA. NO_X construction emissions are more substantial in comparison to the counties' NO_X emissions (in the range of 2%–45%). However, these emissions would be temporary and could be reduced by implementing proposed EPMs (see Table F-1 in Appendix F). Furthermore, this is a conservative analysis of the impact of the construction emissions occurring within 15.5 miles of on-land construction areas and port locations because it assumes all of the emissions would directly affect the nearest county's air. Emissions occurring outside the OCS permit area within 15.5 miles of on-land construction areas and port locations would primarily result from transit vessels used to transport equipment and material. Vessel engines are required to meet certain emission standards and must use low-sulfur diesel fuel. Realistically, vessel transit emissions would be spread out over the transport route. Depending on wind conditions at the time of emissions, it is likely that not all emissions generated miles offshore would reach land. Therefore, Project construction activities would have a temporary **minor** adverse impact on New London, Gloucester, Baltimore, Providence, Washington, Bristol, and Norfolk City Counties' air quality.

Construction emissions occurring offshore in the OCS permit area are not compared to county emission inventories because only a portion of the generated construction emissions would actually reach nearby counties and would depend on wind conditions at the time the emissions are generated. The OCS air permitting process will require air dispersion modeling of these emissions to demonstrate compliance with the NAAQS. If the Project cannot demonstrate compliance, the permit would not be issued, and the Project would not proceed.

The emission totals presented in the analysis represent a worst-case construction scenario in which all construction activities would occur in a single year. Project construction would also have a limited duration, and most emissions would occur offshore. The emissions quantified in Table 3.4-9 would not be emitted entirely at a single point or port and would not continuously affect nearby populated areas. Therefore, impacts on air quality near populated areas would be temporary **minor** adverse.

Table 3.4-9. Summary of Geographic Analysis Area Offshore Construction Emissions (tpy)

Source	CO	NO_X	PM_{10}	$PM_{2.5}$	SO_2	VOC	CO_2e
Construction Emissions within 15.5 Miles of Potential Project On-Land Construction Areas and Port Locations							
RWF-Connecticut	22.3	101.6	3.4	3.3	0.1	3.6	14,980
Percentage of New London County, Connecticut, emission inventory	0.09%	1.92%	0.12%	0.31%	0.03%	0.02%	0.76%
RWF-New Jersey	674.8	2,796.2	94.5	91.2	8.4	49.5	190,927
Percentage of Gloucester County, New Jersey, emission inventory	2.22%	44.66%	4.37%	6.95%	1.40%	0.47%	2.91%
RWF-Maryland	533.4	2,210.3	74.7	72.1	6.6	39.1	150,923
Percentage of Baltimore County, Maryland, emission inventory	0.74%	20.73%	0.61%	2.25%	0.63%	0.23%	3.03%
RWF-Rhode Island	169.5	711.7	24.1	23.3	2.2	14.8	56,604
RWEC-Rhode Island	19.0	78.2	2.6	2.5	0.3	1.4	5,216
Total Rhode Island	**188.5**	**789.9**	**26.7**	**25.8**	**2.5**	**16.2**	**61,820**
Percentage of Providence County, Rhode Island, emission inventory	0.40%	10.12%	0.59%	1.33%	0.53%	0.10%	1.22%
Percentage of Washington County, Rhode Island, emission inventory	1.30%	30.71%	2.28%	4.34%	2.40%	0.22%	9.63%
RWF-Massachusetts	175.4	734.6	24.9	24.0	2.1	14.9	58,274
Percentage of Bristol County, Massachusetts, emission inventory	0.35%	8.26%	0.69%	1.28%	0.24%	0.09%	1.35%
RWF-Virginia	613.5	2,551.6	86.2	83.2	7.5	47.0	182,269
Percentage of Norfolk City, Virginia, emission inventory	2.47%	41.85%	5.72%	12.09%	3.24%	0.80%	16.32%
RWF-maximum potential federal water	2,105.5	8,745.7	293.9	283.9	25.1	153.0	595,830

Source	CO	NO_X	PM_{10}	$PM_{2.5}$	SO_2	VOC	CO_2e
Outer Continental Shelf Permit Area Construction Emissions							
RWF	941.9	3,854.1	125.5	121.3	12.3	80.6	264,307
RWEC-OCS	65.7	270.0	9.0	8.7	0.9	4.8	17,961
Total OCS Permit Area Construction Emissions	**1,007.6**	**4,124.1**	**134.5**	**130.0**	**13.2**	**85.4**	**282,268**

Source: Tech Environmental (2021)

Notes:

RWF-Connecticut = the portion of RWF construction emissions that would occur beyond the OCS permit area and within 15.5 miles of shore during transit to and from the Port of New London.

RWF-New Jersey = the portion of RWF construction emissions that would occur beyond the OCS permit area and within 15.5 miles of shore during transit to and from the Paulsboro Marine Terminal.

RWF-Rhode Island = the portion of RWF construction emissions that would occur beyond the OCS permit area and within 15.5 miles of shore during transit to and from the Port of Providence and the Port of Davisville at Quonset Point.

RWEC-Rhode Island = the portion of RWEC offshore segment construction emissions that would occur outside the OCS permit area and within 15.5 miles of shore.

RWF-Maryland = the portion of RWF construction emissions that would occur beyond the OCS permit area and within 15.5 miles of shore during transit to and from Sparrow’s Point.

RWF-Massachusetts = the portion of RWF construction emissions that would occur beyond the OCS permit area and within 15.5 miles of shore during transit to and from the New Bedford Marine Commerce Terminal and during transit to and from European ports.

RWF-Virginia = the portion of RWF construction emissions that would occur beyond the OCS permit area and within 15.5 miles of shore during transit to and from the Port of Norfolk and during transit to Sparrow’s Point.

RWEC-OCS = the portion of RWEC offshore segment construction emissions that would occur within the OCS permit area.

Onshore Activities and Facilities

Air emissions and climate change: Table 3.4-10 presents the estimated onshore construction emissions for the Project. The onshore facilities, inclusive of the landfall work area, onshore transmission cable, OnSS, and ICF (including associated interconnection circuits and Project easement), would be constructed in Davisville, Washington County, Rhode Island, which is in attainment for all pollutants.

Table 3.4-10. Summary of Emissions from Onshore Facilities Construction (tpy)

Source	CO	NO_X	PM_{10}	$PM_{2.5}$	SO_2	VOC	CO_2e
OnSS and ICF	367.5	382.0	14.6	13.8	1.3	26.8	164,525
Onshore transmission cable	8.9	37.2	1.8	1.8	0.1	2.4	7,342
Horizontal directional drilling in the landfall work area	4.3	14.3	0.7	0.7	0.0	1.0	3,271
Total	**380.7**	**433.5**	**17.1**	**16.3**	**1.4**	**30.2**	**175,138**
Percentage of Kent County, Rhode Island, emission inventory	2.31%	20.26%	1.72%	2.94%	1.18%	0.53%	21.38%
Percentage of Providence County, Rhode Island, emission inventory	0.82%	5.55%	0.38%	0.84%	0.29%	0.18%	3.44%
Percentage of Washington County, Rhode Island, emission inventory	2.62%	16.85%	1.46%	2.74%	1.34%	0.40%	27.28%

Source: Tech Environmental (2021)

Construction of the onshore facilities is estimated to take 18 months, but the air technical report analysis conducted by Tech Environmental (2021) presumes that construction could occur as quickly as 1 year. Construction of the onshore facilities would involve emissions from on-road and non-road equipment, which could have temporary, direct impacts on air quality. The Port of Davisville at Quonset Point would be used for construction support activities. The estimated onshore facilities construction emissions for regulated pollutants were compared to county emission inventories for the counties within 15.5 miles of the Port of Davisville at Quonset Point (the GAA). The Proposed Action onshore facility construction NO_X emissions would be approximately 5.5% of Providence County, Rhode Island's annual NO_X emissions, 16.9% of Washington County, Rhode Island's annual NO_X emissions, and 20.3% of Kent County, Rhode Island's annual NO_X emissions. Most emissions of regulated pollutants were between 0.29% and 2.94% of Kent, Providence, or Washington Counties' annual emissions. Air emissions generated by constructing the onshore facilities could have temporary **minor** adverse impacts on air quality.

3.4.2.2.2 Operations and Maintenance and Decommissioning

Offshore Activities and Facilities

Air emissions and climate change: Emissions from the Project O&M would be much lower than those produced during construction because there would be no direct emissions associated with wind turbine operation. The only air emissions anticipated during O&M would result from crew and maintenance vessels and helicopters. Planned maintenance activities include annual turbine service and safety surveys, annual oil and lubricant changes, annual inspections of turbines and foundations, seafloor and submarine surveys, biannual electrical inspections, regular electrical component servicing, annual scheduled maintenance, and all major and minor corrective maintenance. Table 3.4-11 summarizes the Project O&M emissions estimated for the air quality GAA. Project O&M emissions occurring within 15.5 miles of on-land construction areas and port locations are compared to the emission inventories of the impacted counties. These O&M emissions occurring within 15.5 miles of on-land construction areas and port locations would increase the annual emissions of each pollutant by 1.5% or less for all counties within the GAA.

Project O&M emissions occurring offshore in the OCS permit area are not compared to county emission inventories because only a portion of these emissions would actually reach nearby counties, depending on wind conditions at the time of emission. The OCS air permitting process will require air dispersion modeling of these emissions to demonstrate compliance with the NAAQS. Therefore, Project O&M activities would have a **minor** adverse impact on the air quality in the counties in the GAA.

Project O&M would also generate long-term **minor** beneficial impacts by providing energy to the region from a renewable resource. Currently, the region in which this wind farm would serve obtains between 40% and 51% of its power through the combustion of natural gas (U.S. Energy Information Administration 2021). By replacing a portion of the air pollutant emissions generated by fossil fuel–fired power plants, significant reductions in air pollutants emissions can be achieved. A recent study of current wind projects found that there is a net reduction in emissions within 6 months of the commencement of operations (Inderscience Publishers 2014). Furthermore, as transportation and heating become increasingly electrified, the demand for electrical power will grow. Without offshore wind, states would not be able to meet their emission targets and meet this increasing demand.

Table 3.4-11. Summary of Offshore Operations and Maintenance Emissions (tpy)

Source	CO	NO_X	PM_{10}	$PM_{2.5}$	SO_2	VOC	CO_2e
Operations and Maintenance Emissions within 15.5 Miles of Potential Project On-Land Areas and Port Locations							
RWF-New York	51.2	205.3	6.9	6.7	0.1	3.0	14,506
Percentage of Kings County, New York, emission inventory	0.09%	1.51%	0.14%	0.26%	0.02%	0.02%	0.28%
Percentage of Suffolk County, New York, emission inventory	0.03%	1.01%	0.07%	0.17%	0.01%	0.01%	0.14%
RWF-Rhode Island	3.3	13.0	0.4	0.4	0.0	0.3	1,001
Percentage of Washington County, Rhode Island, emission inventory	0.02%	0.51%	0.03%	0.07%	0.00%	0.00%	0.16%
Outer Continental Shelf Permit Area Emissions							
RWF	207.6	847.7	27.4	26.6	0.6	12.4	57,820

Source: Tech Environmental (2021)

Notes:

RWF-New York = the portion of RWF O&M emissions that would occur outside the OCS permit area and within 15.5 miles from shore during transit to and from the Port of Montauk, Port Jefferson, and the Port of Brooklyn.

RWF-Rhode Island = the portion of RWF O&M emissions that would occur beyond the OCS permit area and within 15.5 miles from shore during transit to and from the Port of Providence and the Port of Davisville at Quonset Point.

In the case of decommissioning, emissions would result largely from the operation of decommissioning equipment and vessels or aircraft. Associated air emissions would occur 35 years in the future when air quality conditions, emissions technology, and regulations would be different; therefore, estimating decommissioning emission impacts now is speculative. Because portions of the Project would be decommissioned in place, fewer decommissioning activities and less equipment would be required; therefore emissions from decommissioning activities would be less than those from construction activities. The decommissioning activities would be subject to a future OCS air permit, or similar, application. There would be no further air emissions from RWF once decommissioning is complete.

The use of wind to generate electricity reduces the need for electricity generation from new traditional fossil fuel–powered plants in New England that produce GHG emissions. BOEM obtained avoided emissions from EPA's AVERT Excel Edition, Version 3.1.1 for the New England region based on EPA's 2019 regional data file. Regional data for 2020 is available, but due to the temporary declines in electricity demands, particularly from March through May 2020 likely caused by the pandemic, the EPA recommends using the 2019 regional data file when assessing annual, near-term future avoided emissions. The EPA's AVERT is not a long-term projection tool. It is not intended to analyze avoided emissions more than 5 years from baseline. The estimated annual and 5-year long-term total avoided emissions are based on minimum and maximum design capacity of the Project (704 MW and 880 MW, respectively). To provide a rough estimate of the long-term avoided emissions of the Project, the maximum and minimum annual avoided emissions estimated by AVERT were multiplied by 5 years. As presented in Table 3.4-12, the Project would annually displace CO_2, NO_X, SO_2, $PM_{2.5}$, VOC, and ammonia (NH_3) produced by the New York electric grid and decrease the creation of air pollutant emissions in the atmosphere from traditional fossil fuel–fired power plants.

Table 3.4-12. Estimated Annual and 5-Year Avoided Emissions for the Operation of the Revolution Wind Farm (tons)

Term	CO_2	NO_X	SO_2	$PM_{2.5}$	VOC	NH_3
Maximum annual avoided emissions	1,771,440	292.01	126.06	50.89	33.07	45.98
Minimum annual avoided emissions	1,415,690	234.75	102.57	40.78	26.43	36.77
Maximum 5-year avoided emissions	8,857,200	1,460.03	630.28	254.43	165.35	229.88
Minimum 5-year avoided emissions	7,078,450	1,173.75	512.83	203.88	132.13	183.85

Source: EPA (2020b)

The EPA's CO-Benefits Risk Assessment (COBRA) screening model Desktop Edition, Version 4.1 was used to estimate the health impacts of avoided emissions in the United States and in the combined area of Connecticut, Maryland, Massachusetts, New Jersey, New York, Rhode Island, and Virginia. The model used the following inputs: 2023 was selected as the analysis year to estimate the health impacts of emissions changes. New York was selected as the state where the emission changes would occur; Fuel Combustion: Electric Utility was the sector where the emission changes would occur; and the AVERT output file for the minimum annual avoided emissions for NO_X, SO_2, $PM_{2.5}$, VOC, and NH_3, as noted in

Table 3.4-12 was loaded into the COBRA application. The model provides estimated ranges of reduced occurrences of health events caused by air pollution, such as mortality, nonfatal heart attacks, and hospitalizations. It also estimates the total health benefit, which encompasses all saved costs of the avoided health events. COBRA includes a discount rate of either 3%, to account for the interest that may be earned from government backed securities, or 7%, to account for private capital opportunity costs. Monetary values presented are in 2017 dollars. The EPA recommends using both for a bounding approach. For the entire United States, COBRA estimates that the total health benefit ranges from $12,096,077 to $27,290,022 at a 3% discount rate and from $10,793,564 to $24,334,469 at a 7% discount rate. COBRA estimates statistical lives saved within the entire United States to range from 1.09 to 2.46 (EPA 2020c). For Connecticut, Maryland, Massachusetts, New Jersey, New York, Rhode Island, and Virginia, combined, COBRA estimates that the total health benefit ranges from $9,891,082 to $22,309,940 at a 3% discount rate and from $8,826,280 to $19,893,704 at a 7% discount rate. COBRA estimates statistical lives saved within Connecticut, Maryland, Massachusetts, New Jersey, New York, Rhode Island, and Virginia, combined, to range from 0.89 to 2.01 (EPA 2020c). For a 5-year estimate for the United States, the total health benefit ranges from $60,480,383 to $136,450,108 at a 3% discount rate and from $53,967,819 to $121,672,344 at a 7% discount rate. Over the course of 5 years, the statistical lives saved within the entire United States is between 5.44 and 12.31. This 5-year estimate is representative of the avoided emissions during operations only. This would represent a long-term **minor** beneficial impact due to avoided health events.

Onshore Activities and Facilities

Air emissions and climate change: Onshore O&M activities would include periodic inspections, preventative maintenance, and regular equipment servicing. Table 3.4-13 presents the estimated onshore facilities O&M emissions for the Project. Annual O&M emissions from onshore facilities range from < 0.01% to 0.01% of Kent, Providence, and Washington Counties' annual emissions. Impacts on air quality from Project onshore facilities' O&M emissions would be **negligible** adverse.

Table 3.4-13. Summary of Emissions from Onshore Facilities Operations and Maintenance (tpy)

Source, State	CO	NO_X	PM_{10}	$PM_{2.5}$	SO_2	VOC	CO_2e
Onshore facilities, Rhode Island	0.6	0.2	0.0	0.0	0.0	0.0	22
Total	**0.6**	**0.2**	**0.0**	**0.0**	**0.0**	**0.0**	**22**
Percentage of Kent County, Rhode Island, emission inventory	< 0.01%	0.01%	< 0.01%	< 0.01%	< 0.01%	< 0.01%	< 0.01%
Percentage of Providence County, Rhode Island, emission inventory	< 0.01%	< 0.01%	< 0.01%	< 0.01%	< 0.01%	< 0.01%	< 0.01%
Percentage of Washington County, Rhode Island, emission inventory	< 0.01%	0.01%	< 0.01%	< 0.01%	< 0.01%	< 0.01%	< 0.01%

Source: Tech Environmental (2021)

Decommissioning activities associated with the onshore facilities would not likely impact air quality in the region. Associated air emissions would occur 35 years in the future when air quality conditions, emissions technology, and regulations would be different; therefore, estimating decommissioning emission impacts now is speculative. Because portions of the Project would be decommissioned in place, fewer decommissioning activities and less equipment would be required; therefore emissions, from decommissioning activities would be less than those from construction activities. There would be no further air emissions from RWF once decommissioning is complete.

3.4.2.2.3 Cumulative Impacts

Offshore Activities and Facilities

Air emissions and climate change: Construction and installation, O&M, and decommissioning emissions associated with the Proposed Action would result in temporary moderate adverse, long-term minor adverse, and long-term minor beneficial impacts on air quality. The Proposed Action's construction emissions (see Tables 3.4-9 and 3.4-10) would noticeably increase emissions of regulated pollutants over the construction emissions generated by other offshore wind projects associated with the No Action Alternative (see Table 3.4-4). Therefore, total cumulative construction-related air emissions from all planned offshore wind energy projects, including the Proposed Action, in the OCS air permit area would consist of an estimated 29,333 tons of NO_X, 189 tons of SO_2, 915 tons of PM_{10}, and 2,186,369 tons of CO_2. However, these effects would be localized and would cease when Project construction is complete.

Table 3.4-14 combines the total estimated construction emissions contributed by the Proposed Action within the OCS air permit area with the estimated local construction emissions that occur beyond the OCS air permit area and within 15.5 miles of shore (RWF-New Jersey, RWF-Massachusetts, RWEC-Rhode Island, etc.). The totals are not compared to county emission inventories because only portions of the Proposed Action construction emissions generated offshore within the OCS air permit area would reach nearby counties, depending on wind conditions at the time of emission. The OCS air permitting process will require air dispersion modeling of these emissions to demonstrate compliance with the NAAQS.

Table 3.4-14. Geographic Analysis Area Offshore Cumulative Construction Emissions (tpy)

Source, State	CO	NO_X	PM_{10}	$PM_{2.5}$	SO_2	VOC	CO_2e
Connecticut							
RWF-Connecticut	22.3	101.6	3.4	3.3	0.1	3.6	14,980
RWF-OCS	941.9	3,854.1	125.5	121.3	12.3	80.6	264,307
RWEC-OCS	65.7	270.0	9.0	8.7	0.9	4.8	17,961
Total Connecticut Emissions	**1,029.9**	**4,225.7**	**137.9**	**133.3**	**13.3**	**89.0**	**297,248**
New Jersey							
RWF-New Jersey	674.8	2,796.2	94.5	91.2	8.4	49.5	190,927
RWF-OCS	941.9	3,854.1	125.5	121.3	12.3	80.6	264,307
RWEC-OCS	65.7	270.0	9.0	8.7	0.9	4.8	17,961
Total New Jersey Emissions	**1,682.4**	**6,920.3**	**229.0**	**221.2**	**21.6**	**134.9**	**473,195**
Maryland							
RWF-Maryland	533.4	2,210.3	74.7	72.1	6.6	39.1	150,923
RWF-OCS	941.9	3,854.1	125.5	121.3	12.3	80.6	264,307
RWEC-OCS	65.7	270.0	9.0	8.7	0.9	4.8	17,961
Total Maryland Emissions	**1,541.0**	**6,334.4**	**209.2**	**202.1**	**19.8**	**124.5**	**433,191**
Rhode Island							
RWF-Rhode Island	169.5	711.7	24.1	23.3	2.2	14.8	56,604
RWEC-Rhode Island	19.0	78.2	2.6	2.5	0.3	1.4	5,216
RWF-OCS	941.9	3,854.1	125.5	121.3	12.3	80.6	264,307
RWEC-OCS	65.7	270.0	9.0	8.7	0.9	4.8	17,961
Total Rhode Island Emissions	**1,196.1**	**4,914.0**	**161.2**	**155.8**	**15.7**	**101.6**	**344,088**

Source, State	CO	NO_X	PM_{10}	$PM_{2.5}$	SO_2	VOC	CO_2e
Massachusetts							
RWF-Massachusetts	175.4	734.6	24.9	24.0	2.1	14.9	58,274
RWF-OCS	941.9	3,854.1	125.5	121.3	12.3	80.6	264,307
RWEC-OCS	65.7	270.0	9.0	8.7	0.9	4.8	17,961
Total Massachusetts Emissions	**1,183.0**	**4,858.7**	**159.4**	**154.0**	**15.3**	**100.3**	**340,542**
Virginia							
RWF-Virginia	613.5	2,551.6	86.2	83.2	7.5	47.0	182,269
RWF-OCS	941.9	3,854.1	125.5	121.3	12.3	80.6	264,307
RWEC-OCS	65.7	270.0	9.0	8.7	0.9	4.8	17,961
Total Virginia Emissions	**1,621.1**	**6,675.7**	**220.7**	**213.2**	**20.7**	**132.4**	**464,537**

Source: Tech Environmental (2021)

Notes:

RWF-Connecticut = the portion of RWF construction emissions that would occur beyond the OCS permit area and within 15.5 miles of shore during transit to and from the Port of New London.

RWF-New Jersey = the portion of RWF construction emissions that would occur beyond the OCS permit area and within 15.5 miles of shore during transit to and from the Paulsboro Marine Terminal.

RWF-Rhode Island = the portion of RWF construction emissions that would occur beyond the OCS permit area and within 15.5 miles of shore during transit to and from the Port of Providence and the Port of Davisville at Quonset Point.

RWEC-Rhode Island = the portion of RWEC offshore segment construction emissions that would occur outside the OCS permit area and within 15.5 miles of shore.

RWF-Maryland = the portion of RWF construction emissions that would occur beyond the OCS permit area and within 15.5 miles of shore during transit to and from Sparrow's Point.

RWF-Massachusetts = the portion of RWF construction emissions that would occur beyond the OCS permit area and within 15.5 miles of shore during transit to and from the New Bedford Marine Commerce Terminal and during transit to and from European ports.

RWF-Virginia = the portion of RWF construction emissions that would occur beyond the OCS permit area and within 15.5 miles of shore during transit to and from the Port of Norfolk and during transit to Sparrow's Point.

RWEC-OCS = the portion of RWEC offshore segment construction emissions that would occur within the OCS permit area.

RWF-OCS = the portion of RWF construction emissions that occur within the OCS permit area.

Air quality impacts from O&M of the Proposed Action, provided in Tables 3.4-11 and 3.4-13, would combine with the air quality impacts from all other O&M activities that could occur under the No Action Alternative (see Table 3.4-7), albeit at lower emission quantities compared to the construction and installation period. O&M emissions would noticeably add emissions in localized areas, several times per year, for the life of the Project. Total cumulative operation-related air emissions from all of the planned wind projects, including the Proposed Action, in the OCS air permit area would consist of an estimated 2,060 tons of NO_X, 5 tons of SO_2, 60 tons of PM_{10}, and 168,623 tons of CO_2.

If annual O&M emissions emitted by the Proposed Action within the OCS air permit area are combined with the estimated annual O&M emissions emitted by the Proposed Action within 15.5 miles of the on-land areas and port locations in New York (RWF – New York), and if this summed, conservative total is compared to the 2017 National Emission Inventory for Kings and Suffolk Counties, New York, Kings County would see a 0.2% to 7.8% increase (depending on the pollutant) in its regulated pollutant annual emissions, whereas Suffolk County would see a 0.06% to 5.2% increase in its regulated pollutant annual emissions. Similarly, if the total annual O&M emissions emitted by the Proposed Action within the OCS air permit area are combined with the estimated annual O&M emissions emitted by the Proposed Action within 15.5 miles of the on-land areas and port locations in Rhode Island (RWF – Rhode Island), and if this summed, conservative total is compared to Washington County, Rhode Island's 2017 National Emission Inventory, there would be a 0.6% to 33.5% increase in its regulated pollutant annual emissions. These are very conservative estimated increases because not all of the annual O&M emissions generated within the OCS air permit area would impact each nearby county in turn. Instead, only a portion of emissions generated within the OCS air permit area would actually reach land, depending on wind conditions at the time of emission.

Table 3.4-15. Geographic Analysis Area Offshore Cumulative Operations and Maintenance Emissions (tpy)

Source, State	CO	NO_X	PM_{10}	$PM_{2.5}$	SO_2	VOC	CO_2e
New York							
RWF-New York	51.2	205.3	6.9	6.7	0.1	3.0	14,506
RWF-OCS	207.6	847.7	27.4	26.6	0.6	12.4	57,820
Total New York Emissions	**258.8**	**1,053.0**	**34.3**	**33.3**	**0.7**	**15.4**	**72,326**
Percentage of Kings County, New York, emission inventory	0.44%	7.76%	0.69%	1.30%	0.15%	0.09%	1.41%
Percentage of Suffolk County, New York, emission inventory	0.18%	5.18%	0.35%	0.86%	0.06%	0.05%	0.69%
Rhode Island							
RWF-Rhode Island	3.3	13.0	0.4	0.4	0.0	0.3	1,001
RWF-OCS	207.6	847.7	27.4	26.6	0.6	12.4	57,820
Total Rhode Island Emissions	**210.9**	**860.7**	**27.8**	**27.0**	**0.6**	**12.7**	**58,821**
Percentage of Washington County, Rhode Island, emission inventory	1.45%	33.46%	2.37%	4.55%	0.58%	0.17%	9.16%

Source: Tech Environmental (2021)

Notes:

RWF-New York = the portion of RWF O&M emissions that would occur outside the OCS permit area and within 15.5 miles from shore during transit to and from the Port of Montauk, Port Jefferson, and the Port of Brooklyn.

RWF-Rhode Island = the portion of RWF O&M emissions that would occur beyond the OCS permit area and within 15.5 miles from shore during transit to and from the Port of Providence and the Port of Davisville at Quonset Point.

RWF-OCS = the portion of RWF construction emissions that occur within the OCS permit area.

The Proposed Action would also have a noticeable contribution on existing GHG emissions. The construction and installation, O&M, and the eventual decommissioning of the Proposed Action would generate approximately 515,248 metric tons more CO_2e emissions over the No Action Alternative within the OCS air permit area. However, these contributions are small in proportion to aggregate national and global emissions. In 2019, U.S. GHG emissions totaled 6,558 million metric tons of CO_2e (EPA 2021c).

While cumulative air emissions in the region would increase during construction, the Project could also contribute to a long-term, cumulative net decrease in emissions by substituting some existing fossil fuel sources with a renewable source. As presented in Table 3.4-12, the Proposed Action would avoid an estimated minimum of 235 tons of NO_X, 103 tons of SO_2, 41 tons of $PM_{2.5}$, 26 tons of VOC, 37 tons of NH_3, and 1,415,690 tons of CO_2 every year and would avoid an estimated maximum of 292 tons of NO_X, 126 tons of SO_2, 51 tons of $PM_{2.5}$, 33 tons of VOC, 46 tons of NH_3, and 1,771,440 tons of CO_2 every year by providing energy generation that existing fossil fuel–generated energy sources would have otherwise provided (EPA 2020b). This represents up to an estimated 5.3% to 6.2% increase in avoided emissions over the No Action Alternative on an annual basis. When combined with estimated avoided emissions under the No Action Alternative (see Table 3.4-3), offshore wind projects could cumulatively avoid an estimated minimum of 4,149 tons of NO_X, 1,759 tons of SO_2, 724 tons of $PM_{2.5}$, 471 tons of VOC, 653 tons of NH_3, and 25,266,226 tons of CO_2 every year and would avoid an estimated maximum of 5,772 tons of NO_X, 2,440 tons of SO_2, 1,008 tons of $PM_{2.5}$, 655 tons of VOC, 909 tons of NH_3, and 35,186,254 tons of CO_2 every year.

Based on the above considerations, BOEM anticipates that the overall cumulative impacts associated with the Proposed Action when combined with other past, present, and reasonably foreseeable activities would be **moderate** adverse, although regional air quality could be improved over the Project lifecycle when compared to the No Action Alternative.

Onshore Activities and Facilities

Air emissions and climate change: Project onshore facilities would result in temporary to long-term negligible to minor adverse air emissions as a result of on-road and non-road equipment use. The Proposed Action onshore facility construction NO_X emissions are approximately 5.5% of Providence County, Rhode Island’s annual NO_X emissions, 16.9% of Washington County, Rhode Island’s annual NO_X emissions and 20.3% of Kent County, Rhode Island’s annual NO_X emissions.

Most O&M annual emissions of regulated pollutants were between 0.29% and 2.94% of Kent, Providence, or Washington Counties’ annual emissions. Annual O&M emissions from onshore facilities would have a negligible adverse impact, ranging from < 0.01% to 0.01% of Kent, Providence, and Washington Counties’ annual emissions. When combined with other onshore sources of air emissions, cumulative impacts on air quality would be long term **minor** adverse.

3.4.2.2.4 Conclusions

Construction and installation and decommissioning activities would cause increased air emissions temporarily. Emission sources from O&M activities would primarily use vehicles and vessels that emit less emissions than during construction and installation and decommissioning activities, and fewer annual trips would be needed. Therefore, BOEM expects the impact on air quality from the Proposed Action alone to be **minor** adverse due to air emissions from construction activities. While cumulative air emissions in the region would increase during construction, it is important to note that the Proposed Action could also contribute to a long-term net decrease in emissions by substituting some existing fossil fuel sources with a renewable source. By substituting some fossil fuel sources with a renewable source with less emissions, the Proposed Action would generate long-term **minor** beneficial impacts to regional air quality by contributing to a long-term net decrease in emissions in the region.

Considering all the IPFs together, BOEM anticipates that the overall cumulative impacts associated with the Proposed Action when combined with other past, present, and reasonably foreseeable activities would remain **moderate** adverse, although regional air quality could be improved when compared to the No Action Alternative.

3.4.2.3 Alternatives C, D, E, and F

Table 3.4-7 provides a summary of IPF findings for these alternatives.

3.4.2.3.1 Conclusions

Although Alternatives C through F would reduce the number of allowable WTGs and their associated IACs, which would likely have an associated reduction in associated vessel and equipment use and air emissions, BOEM expects the impacts from each alternative would be similar to the Proposed Action: **minor** adverse due to air emissions from construction activities. Project O&M would also contribute to long-term **minor** beneficial impacts by substituting some fossil fuel sources of electricity generation with a lower emitting renewable source and thus, would result in a net reduction in cumulative air emissions in the region.

In the context of other reasonably foreseeable environmental trends and planned actions, BOEM also expects that each alternative's impacts would be similar to the Proposed Action (with individual IPFs leading to impact that would be short term **minor** adverse and long term **minor** beneficial). The overall cumulative impacts of each alternative on air quality when combined with past, present, and reasonably foreseeable activities would therefore be the same as under the Proposed Action: **moderate** adverse, with potential regional improvements to air quality when compared to the No Action Alternative. Overall adverse effects would be notable, but the resource would recover completely from adverse impacts.

3.4.2.4 Mitigation

No potential additional mitigation measures for air quality are identified in Table F-2 in Appendix F.

3.5 Bats

3.5.1 Description of the Affected Environment and Environmental Consequences of the No Action Alternative for Bats

Geographic analysis area: Although historic anecdotal observations of bats up to 1,212 miles (1,950 km) offshore North America exist, recent offshore observations of tree bats range from 10.5 to 26.0 miles (16.9 to 41.8 km) (Hatch et al. 2013). For this reason, and to capture most of the movement range for migratory bat species, the GAA for bats consists of the United States coastline from Maine to Florida and extends 100 miles (160.9 km) offshore and 5 miles (8.05 km) inland to capture the movement range for species in this group (Figure 3.5-1).

Northern long-eared bats (*Myotis septentrionalis*) and other cave bats typically do not occur on the OCS. Tree bats are long-distance migrants; their range includes most of the Atlantic coast from Florida to Maine. Although these species have been documented on the open ocean and could encounter WTGs, use of offshore habitat is thought to be limited and generally restricted to spring and fall migration. The onshore limit of the GAA is 0.5 mile (0.8 km) inland to cover onshore habitats used by the bat species that may be affected by offshore components of the proposed Project as well as those species that could be affected by proposed onshore Project components. The onshore limit of the GAA is intended to cover most of the onshore habitat used by those bat species that may encounter the Project during most of their life cycles.

Affected environment: This section provides information on existing bat species and habitat trends from past and present activities. Bats within the GAA are subject to pressure from ongoing activities generally associated with onshore impacts, including onshore construction and climate change. Onshore construction activities and associated impacts are expected to continue at current trends and have the potential to result in impacts on bat species. The Vineyard Wind Final EIS (BOEM 2021a), the South Fork Wind Farm (SFWF) Final EIS (BOEM 2021b), and COP Appendix AA (Biodiversity Research Institute [bri] 2021) provide detailed discussions of existing bat resources as well as bat species and habitat trends along the East Coast, which are incorporated by reference. Appendix E1 of this EIS provides additional information regarding past and present activities and associated impacts to bats.

Eight bat species are present in the state of Rhode Island, five of which are likely year-round residents. Bat species that may occur in the offshore and onshore portions of the Lease Area are the long-distance migrants and the non-migrating cave-dwelling bats. Long-distance migrants consist of hoary bat (*Lasiurus cinereus*), eastern red bat (*Lasiurus borealis*), and silver-haired bat (*Lasionycteris noctivagans*). Non-migratory cave dwellers consist of northern long-eared bat, little brown bat (*Myotis lucifugus*), eastern small-footed bat (*Myotis leibii*), big brown bat (*Eptesicus fuscus*), and tri-colored bat (*Perimyotis subflavus*) (see Table 2-3 in COP Appendix AA [bri 2021]). Both groups of bats are nocturnal insectivores that use a variety of forested and open habitats for foraging during the summer (Barbour and Davis 1969). Cave-hibernating bats are generally not observed offshore (Dowling and O'Dell 2018) and in winter migrate from summer habitat to hibernacula in the region (Maslo and Leu 2013). Migratory tree bats fly to southern parts of the United States in the winter and have been observed offshore during migration (Hatch et al. 2013; Stantec Consulting Services Inc. [Stantec] 2016, 2018).

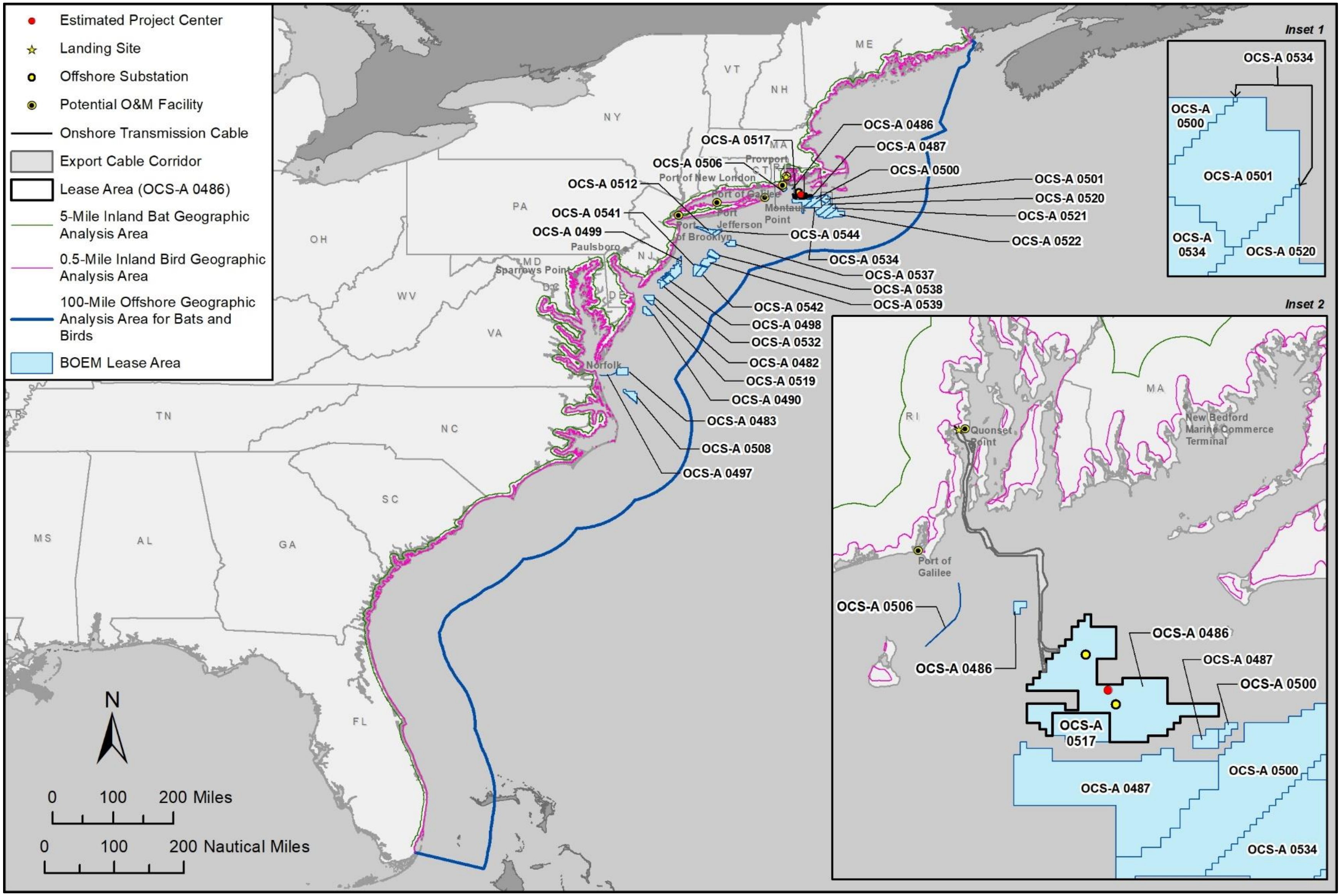

Figure 3.5-1. Geographic analysis area for bats.

Offshore

Although there is uncertainty on the specific movements of bats offshore, bats have been documented using the marine environment in the United States (Cryan and Brown 2007; Dowling and O'Dell 2018; Grady and Olson 2006; Hatch et al. 2013; Johnson et al. 2011; Stantec 2016). Bats have been observed to temporarily roost on structures, such as lighthouses on nearshore islands (Dowling et al. 2017). There is also historical evidence of bats, particularly eastern red bats, migrating offshore in the Atlantic (Hatch et al. 2013). In a mid-Atlantic bat acoustic study conducted during the spring and fall of 2009 and 2010 (86 nights), the maximum distance that bats were detected from shore was 13.6 miles (21.9 km), and the mean distance was 5.2 miles (8.4 km) (Sjollema et al. 2014). In Maine, bats were detected on islands up to 25.8 miles (41.6 km) from the mainland (Peterson et al. 2014). In the mid-Atlantic acoustic study (Sjollema et al. 2014), eastern red bats made up 78% (166 bat detections during 898 monitoring hours) of all bat detections offshore. This study also found that bat activity decreased as wind increased (Sjollema et al. 2014). In addition, eastern red bats were detected in the mid-Atlantic up to 27.3 miles (44 km) offshore, outside the vicinity of islands or other structures, by high-resolution video aerial surveys (Hatch et al. 2013). Shipboard acoustic surveys conducted by Stantec in 2017 detected over 900 bat passes (primarily long-distance migratory tree bats) within the adjacent proposed SFWF Lease Area, export cable route, and adjacent offshore and coastal areas. Eastern red bats accounted for 69% of calls detected, whereas silver-haired bats accounted for 13%. All other species accounted for less than 5% of calls that were identified to species level. Peak detections for all species occurred during the month of August, suggesting that most offshore movement is associated with fall migration (Stantec 2018).

Several studies highlight the relationship between bat activity and weather conditions. Acoustic monitoring within the footprint of the proposed SFWF in southern New England found 82% of recorded bat passes with corresponding weather data occurred when wind speeds were < 5.0 meters/second (m/s) and temperatures were ≥ 15.0°C (Stantec 2018). This occurred during 49% of nighttime hourly rounded weather data increments during the monitoring period from July 14 to November 15. These weather conditions most often occurred from August through September. Bat activity occurred primarily during nights with warmer temperatures and low wind speeds, which has been likewise documented in several other studies (Fiedler 2004; Reynolds 2006; Stantec 2016). Similar monitoring at the operational Block Island Wind Farm in Rhode Island found that 90% of bat passes occurred at times when wind speeds were below 5.0 m/s and temperatures were at or above 15.0°C (Stantec 2018). Both studies reported very little activity at temperatures below 15.0°C, and most activity was documented at wind speeds between 2 and 4 m/s. Smith and McWilliams (2016) developed predictive models of regional nightly bat activity using continuous acoustic monitoring at several locations in coastal Rhode Island. Bat activity was found to steadily decrease with decreasing temperatures, and departures from seasonally normal temperatures increasingly inhibited bat activity later in the season (September through October). This study found no association between wind speed and bat activity, which contrasts with most other literature that shows bat activity is associated with relatively low wind speeds (Arnett et al. 2008; Cryan and Brown 2007; Fiedler 2004; Kerns et al. 2005), although wind speed data were regional and not site specific.

Cave-hibernating bats hibernate regionally in caves, mines, and other structures and primarily feed on insects in terrestrial and freshwater habitats. These species generally exhibit lower activity in the offshore environment than migratory tree bats (Sjollema et al. 2014), with movements primarily occurring during the fall. In the region, the maximum distance *Myotis* bats were detected offshore was 7.2 miles (11.5 km) (Sjollema et al. 2014). A recent nanotag tracking study on Martha's Vineyard recorded little brown bat (n = 3) movements off the island in late August and early September, with one individual flying from Martha's Vineyard to Cape Cod (Dowling et al. 2017). Big brown bats (n = 2) were also detected migrating from the island later in the year (October–November) (Dowling et al. 2017). These findings are supported by an acoustic study conducted on islands and buoys in the Gulf of Maine that indicated the greatest percentage of activity in July–October (Peterson et al. 2014). Presence in the Lease Area is considered rare for this group given the use of the coastline as a migratory pathway by cave-hibernating bats is likely limited to their fall migration period; acoustic studies indicate lower use of the offshore environment by cave-hibernating bats; and cave-hibernating bats do not regularly feed on insects over the ocean (bri 2021).

Tree bats migrate south to overwinter and have been documented in the GAA's offshore environment (Hatch et al. 2013; Stantec 2018, 2019). Eastern red bats have been detected migrating from Martha's Vineyard late in the fall, with one individual tracked as far south as Maryland (Dowling et al. 2017). These results are supported by historical observations of eastern red bats offshore as well as recent acoustic survey results (Hatch et al. 2013; Peterson et al. 2014; Sjollema et al. 2014). Although little local data are available, shipboard and stationary acoustic surveys recorded several observations of bats flying over the ocean, with detections of migratory tree bats near the Lease Area (Stantec 2018). Tree bats may pass through the Lease Area during the migration period because they have been detected in the offshore environment primarily during late summer and fall. However, because bat movement offshore is generally limited to fall migration and bat activity offshore primarily occurs during wind speeds below 5.0 m/s, exposure to the Lease Area is expected to be low as the average wind speeds in the Lease Area are between 5 and 10 m/s with stronger wind in the winter (bri 2021:Section 4.2.4.1). Therefore, there is little evidence of bat use of the offshore environment and a low proportion of the population is exposed.

Onshore

In July 2020, vhb performed acoustic presence-absence surveys for the federally threatened northern long-eared bat along the onshore transmission cable route and within the proposed OnSS parcel (vhb 2021). Automated and qualitative analysis of acoustic data did not detect presence of the northern long-eared bat or the tri-colored bat, which is a candidate species for listing under the Endangered Species Act (ESA). Call data were auto classified with Bat Call Identification East, Version 2.8b, which resulted in the detection of the following species: big brown bat (n = 540 calls), eastern red bat (n = 891 calls), hoary bat (n = 23 calls), and silver-haired bat (n = 130 calls). Qualitative analysis of unknown species of concern calls confirmed 11 big brown bat calls and 135 eastern red bat calls (vhb 2021).

Special-Status Bat Species

The official species list generated by Information for Planning and Consultation (IPaC) on September 28, 2019, indicates that the federally threatened northern long-eared bat has the potential to occur within the footprint of the onshore facilities (vhb 2021). A Final 4(d) Rule specific to "take" prohibitions of the northern long-eared bat was published in the *Federal Register* on January 14, 2016 (U.S. Fish and Wildlife Service [USFWS] 2016). *Take* is defined by the ESA as "to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect" any species listed under the ESA. The IPaC list also indicates that there are no critical habitats associated with the northern long-eared bat within the GAA. The range of the federally endangered Indiana bat (*Myotis sodalis*) does not include Rhode Island, and historical records of the Indiana bat demonstrate its presence only in Berkshire and Hampden Counties in Massachusetts (last recorded in 1939; Mass.gov 2019). The Indiana bat is also not among species of bats documented offshore (Pelletier et al. 2013; Stantec 2016). For these reasons, this assessment focuses solely on the potential occurrence of northern long-eared bats within the GAA. A detailed species account and further information on this species is provided in the RWF biological assessment (BA) prepared for the USFWS (BOEM 2022).

Northern long-eared bats are not expected to occur within the Lease Area. A recent tracking study on Martha's Vineyard (n = 8; July–October 2016) did not record any offshore movements, and bats were presumed to hibernate on the island (Dowling et al. 2017). However, shipboard acoustic sampling near the SFWF detected a single northern long-eared bat call 21.1 miles (34 km) offshore (Stantec 2018). Most other northern long-eared bat passes detected during these surveys were 3 to 9 miles (5–14 km) offshore. Stationary acoustic detectors positioned on two turbines within the operational Block Island Wind Farm did not detect any northern long-eared bat calls (Stantec 2018, 2020). Similarly, vessel-based surveys at the construction site of the Block Island Wind Farm in 2016 did not detect any *Myotis* species (Stantec 2016). If northern long-eared bats were to migrate over water, most movements would likely be near the mainland. The related little brown bat has been documented migrating from Martha's Vineyard to Cape Cod, and northern long-eared bats may likewise migrate to mainland hibernacula from these islands in August and September (Dowling et al. 2017). Given that there is little evidence of use of the offshore environment by northern long-eared bats, exposure is expected to be minimal, and this species is not further assessed. This conclusion is also consistent with the Vineyard Wind BA (BOEM 2020).

3.5.1.1 Future Offshore Wind Activities (without Proposed Action)

This section discloses potential bat impacts associated with future offshore wind development. Analysis of impacts associated with ongoing activities and future non–offshore wind activities is provided in Appendix E1.

<u>Cable emplacement/maintenance:</u> A small amount of infrequent construction impacts associated with onshore power infrastructure would be required over the next 6 to 10 years to tie future offshore wind energy projects to the electric grid. Typically, this would require only small amounts of habitat removal, if any, and would occur in previously disturbed areas. Short-term temporary impacts associated with habitat loss or avoidance during cable emplacement/maintenance may occur, but no injury or mortality of bat individuals would be expected. Cable emplacement/maintenance is therefore expected to have **negligible** adverse impacts on bats.

<u>Light:</u> Lighting sources on the WTGs and OSSs may serve as an attractant to bats as they navigate, or bats may be indirectly attracted to insect prey drawn to the lights. The lack of bat carcasses reported during large-scale bird-related fatality events at illuminated lighthouses, lightships, and oil or research platforms indicates that bats do not appear to be as susceptible to these types of collision risks as some birds (Stantec 2018). The wind turbines may also be lit with aviation lighting; however, aviation lighting has not been found to influence bat collision risk at onshore facilities in North America (Arnett et al. 2008). Based on collision mortalities documented at onshore wind farms, the behavioral vulnerability to collision due to offshore lighting for all bat species would be **negligible** adverse.

<u>Noise:</u> Anthropogenic noise on the OCS associated with future offshore wind development, including noise from pile driving and construction activities (e.g., use of noise-producing heavy equipment or machinery), could impact bats on the OCS. Noise from pile driving would occur during installation of

foundations for offshore structures at a frequency of 4 to 6 hours at a time over 6 to 10 years. Construction activity would be short term, temporary, and highly localized. Further, the majority of these activities would take place during the day while bats are in torpor. A study evaluated the effect of noise on torpid bats and found that bats responded most strongly to colony and vegetation noise and most weakly to traffic noise (Luo et al. 2014). The study also documented evidence that torpid bats can rapidly habituate to repeated and prolonged noise disturbance, suggesting that traffic noise is less disturbing to torpid bats than colony or vegetation noise (Luo et al. 2014). Another study found that bats avoided foraging areas subjected to strong noise impacts (Schaub et al. 2008). This study suggests that foraging areas close to highways and other sources of intense broadband noises are degraded in their suitability as foraging areas for “passive listening” bats (Schaub et al. 2008). Because most construction activities would generally not be conducted during the active bat foraging period between twilight and sunrise, most noise generated from construction activities is not expected to impact bat foraging behavior. Luo et al. (2014) demonstrated that bat response to traffic noise was low relative to other stimuli (e.g., colony noise, vegetation) and that bats rapidly habituate to prolonged noise disturbance. Auditory impacts are not expected to occur because recent research shows that bats may be less sensitive to temporary threshold shifts than other terrestrial mammals (Simmons et al. 2016). Construction activities could generate noise sufficient to cause avoidance behavior by individual migrating tree bats (Schaub et al. 2008), thus potentially causing habitat-related impacts (i.e., displacement). These impacts would likely be limited to behavioral avoidance of pile driving and/or construction activities (e.g., use of noise-producing heavy equipment or machinery), and no temporary or permanent hearing loss would be expected (Simmons et al. 2016). However, these impacts are unlikely because little use of the OCS is expected by bats, and only during spring and fall migrations. Therefore, based on available information, noise impacts resulting from construction of offshore facilities would be temporary **negligible** adverse.

Some potential for short-term, temporary, and localized habitat impacts arising from onshore construction noise exists; however, no auditory impacts on bats would be expected. As discussed with offshore construction noise, recent literature suggests that bats are less susceptible to temporary or permanent hearing loss from exposure to intense sounds (Simmons et al. 2016). Impacts would be limited to individuals roosting adjacent to onshore construction locations. Nighttime work may be required on an as-needed basis, which could impact foraging bats. Some temporary displacement and/or avoidance of potentially suitable foraging habitat could occur, but these impacts would not be biologically significant. Some bats roosting near construction activities may be disturbed during construction, but they would move to a different roost farther from construction noise. This would not result in any impacts because frequent roost switching is common among bats (Hann et al. 2017; Whitaker 1998). Based on available information, noise impacts resulting from construction of the onshore facilities would be temporary **negligible** adverse.

Nonroutine activities associated with offshore wind facilities would generally require intense temporary activity to address emergency conditions. The noise made by onshore construction equipment or offshore repair vessels could temporarily deter bats from approaching the site of a given nonroutine event. Impacts on bats, if any, would be temporary and last only as long as repair or remediation activities were necessary to address these nonroutine events.

Given the temporary and localized nature of potential impacts and bats’ expected biologically insignificant response, impacts on bats are expected to be **negligible** adverse. No individual fitness (i.e., a bat's ability to survive and reproduce) or population-level impacts would occur as a result of onshore or offshore noise associated with future offshore wind development.

Presence of structures: In addition to electrical infrastructure, some habitat conversion may result from port expansion activities required to meet the demands for fabrication, construction, transportation, and installation of wind energy structures. The general trend along the coastal region from Virginia to Maine is that port activity will increase modestly and require some conversion of undeveloped land to meet port demand and will result in permanent habitat loss for local bat populations. However, the noticeable increase from future offshore wind development would be a minimal contribution in the port expansion required to meet increased commercial, industrial, and recreational demand (BOEM 2019b). The current bearing capacity of existing ports is considered suitable for wind turbines, requiring no port modifications for supporting offshore wind energy development (U.S. Department of Energy [2014]).

Using the assumptions in Table E-4 in Appendix E, the cumulative offshore wind activities scenario would include up to 3,008 WTGs on the OCS that could result in potential impacts on bats. Cave bats (including the federally threatened northern long-eared bat and the state-endangered eastern small-footed bat, little brown bat, and tri-colored bat) rarely occur offshore (even during fall migration) and, therefore, exposure to construction vessels during construction or maintenance activities, or the rotor swept zone (RSZ) of operating WTGs in the lease areas, is expected to be **negligible** adverse, if exposure occurs at all (Pelletier et al. 2013).

Tree bats, however, may pass through offshore WEAs on the OCS during the fall migration, with limited potential for migrating bats to encounter vessels during construction and decommissioning of WTGs, electric service platforms, and offshore export cable corridors, although structure and vessel lights may attract bats because of the increased prey abundance. As discussed above, although bats have been documented at offshore islands, relatively little bat activity has been documented in open water habitat similar to the conditions in the WEAs (Stantec 2018, 2020). Several studies, such as Cryan and Barclay (2009), Cryan et al. (2014), and Kunz et al. (2007), discuss several hypotheses as to why bats may be attracted to WTGs. Many of these, including the creation of linear corridors, altered habitat conditions, or thermal inversions, would not apply to WTGs on the Atlantic OCS (Cryan and Barclay 2009; Cryan et al. 2014; Kunz et al. 2007). Other hypotheses associated with the Atlantic OCS regarding bat attraction to WTGs include bats perceiving the WTGs as potential roosts, potentially increased prey base, visual attraction, disorientation due to electromagnetic fields or decompression, or attraction due to mating strategies (Arnett et al. 2008; Cryan 2007; Kunz et al. 2007). However, no definitive answer as to why, if at all, bats are attracted to WTGs has been postulated, despite intensive studies at onshore wind facilities. For this reason, some bats may encounter, or perhaps be attracted to, the expected structures (i.e., electric service platforms and non-operational WTG towers) to opportunistically roost or forage. However, bats' echolocation abilities and agility make it unlikely that these stationary objects (i.e., electric service platforms and non-operational WTGs) or moving vessels would pose a collision risk to migrating individuals. This assumption is supported by the evidence that bat carcasses are rarely found at the base of onshore turbine towers (Choi et al. 2020).

Tree bat species that may encounter operating WTGs in the offshore lease areas include the eastern red bat, the hoary bat, and the silver-haired bat. Offshore O&M would present a seasonal risk factor to migratory tree bats that may use offshore habitats during fall migration. Although some potential exists for migrating tree bats to encounter operating WTGs during fall migration, the overall occurrence of bats on the OCS is relatively very low (Stantec 2016). With the proposed 1-nm (1.9-km) spacing between structures associated with future offshore wind development and the distribution of anticipated projects, individual bats migrating over the OCS within the RSZ of project WTGs would likely pass through projects with only slight course corrections, if any, to avoid operating WTGs. Further, unlike terrestrial migration routes there are no landscape features that would concentrate bats and increase exposure to the WEAs on the OCS (Baerwald and Barclay 2009; Cryan and Barclay 2009; Fiedler 2004; Hamilton 2012; Smith and McWilliams 2016). This combined with the expected infrequent and limited use of the OCS by migrating tree bats suggests very few individuals would encounter operating WTGs or other structures associated with future offshore wind development. Additionally, the potential collision risk to migrating tree bats varies with climatic conditions. For example, bat activity is associated with relatively low wind speeds and warm temperatures (Arnett et al. 2008; Cryan and Brown 2007; Fiedler 2004; Kerns et al. 2005). Given the rarity of tree bats in the offshore environment, the turbines being widely spaced apart, and the patchiness of expected projects on the OCS, the likelihood of collisions is expected to be low. Additionally, the likelihood of a migrating individual encountering one or more operating WTGs during adverse weather conditions is extremely low because bats have been shown to suppress activity during periods of strong winds, low temperatures, and rain (Arnett et al. 2008; Erickson et al. 2002).

For these reasons, the likelihood of exposure of tree bats to construction vessels during construction or maintenance activities, or the RSZ of operating WTGs in the lease areas, is very low, and therefore related impacts are expected to be **negligible** adverse.

3.5.1.2 Conclusions

Under the No Action Alternative, the Project would not be built. Impacts from ongoing future non–offshore and offshore wind development activities would still occur. BOEM expects ongoing activities, future non–offshore wind development, and future offshore wind development to have continuing temporary to permanent impacts (e.g., disturbance, displacement, injury, mortality, and habitat conversion) on bats primarily through the onshore construction impacts, the presence of structures, and climate change. BOEM anticipates that the potential impacts of ongoing activities would be **negligible** adverse. In addition to ongoing activities, BOEM anticipates that the impacts of planned actions other than offshore wind development may also contribute to impacts on bats, including increasing onshore construction (see Appendix E1), but that these impacts would be **negligible** adverse. BOEM expects the combination of ongoing and planned actions other than offshore wind development to result in **negligible** adverse impacts on bats. Although the impacts from a substitute project may differ in location and time, depending on where and when offshore wind facilities are developed to meet the remaining demand, the nature of impacts and the total number of WTGs would be similar either with or without the Proposed Action. The No Action Alternative would forgo applicant-committed postconstruction acoustic monitoring for bats and annual mortality reporting. Their results could provide an understanding of the effects of offshore wind development, benefit the future management of these species, and inform planning of other offshore development. However, ongoing and future surveys and monitoring could still supply similar data.

Considering all the IPFs together, BOEM anticipates that the overall impacts associated with future offshore wind activities in the GAA would result in **negligible** adverse impacts from ongoing climate change, lighting, interactions with operating WTGs on the OCS, and onshore habitat loss. Given the infrequent and limited anticipated use of the OCS by migrating tree bats during spring and fall migration, as well as cave bats not typically occurring on the OCS, the IPFs associated with future offshore wind activities that occur offshore would not appreciably contribute to overall impacts on bats. Future offshore wind development could result in some potential for temporary disturbance and permanent loss of onshore bat habitat. However, habitat removal is anticipated to be minimal when compared to other past, present, and reasonably foreseeable activities. Any impacts resulting from habitat loss or disturbance would not be expected to result in individual fitness or population-level effects within the GAA.

3.5.2 Environmental Consequences

3.5.2.1 Relevant Design Parameters, Impact-Producing Factors, and Potential Variances in Impacts

This assessment analyzes the maximum-case scenario; however, there is the potential for variances in the proposed Project build-out, as defined in the PDE (see Appendix D). The Project design parameters that would influence the magnitude of the impacts on bats include the number, size, and location of WTGs; the location of the OnSS and ICF; the type of lighting to be used; the location of construction within the landfall work area and within the transmission cable envelope; and the time of year during which construction occurs. Impacts associated with construction of the onshore elements of the Proposed Action during the active season for bats (generally April through October) could be avoided if onshore construction occurs outside this time frame.

The following EPMs would be implemented to minimize potential impacts to bats:

- Revolution Wind evaluated siting alternatives for the OnSS using the criteria that included avoidance or minimization of disturbance to ecologically sensitive areas.
- The OnSS and ICF would be located on parcels that are already highly altered and include buried demolition waste.
- The transmission cable would be located primarily in unvegetated and previously disturbed or developed ROWs.

These EPMs would be implemented across all alternatives; therefore, BOEM would not expect measurable potential variances in impacts across the alternatives.

See Appendix E1 for a summary of IPFs analyzed for bats across all action alternatives. IPFs that are either not applicable to the resource or determined by BOEM to have a negligible adverse impact are excluded from Chapter 3 and provided in Table E1-4 in Appendix E1. Offshore and onshore IPFs are addressed separately in the analysis if appropriate for the resource; not all IPFs have both an offshore and onshore component. Where feasible, calculations for specific alternative impacts are provided in Appendix E4, to facilitate reader comparison across alternatives.

Table 3.5-1 discloses IPF findings carried forward for analysis in this section. Each alternative analysis discussion consists of the construction and installation phase, the O&M phase, the decommissioning phase, and the cumulative analysis. If these analyses are not substantially different, then they are presented as one discussion.

The overall impact to bats from any action alternative would be **minor** adverse, as the effects would be small, and the resource would recover completely, with no mitigating action required. The conclusion section for each alternative analysis provides additional rationale for this impact determination.

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Table 3.5-1. Alternative Comparison Summary for Bats

Impact-Producing Factor	No Action Alternative	Alternative B (Proposed Action) up to 100 WTGs	Alternative C (Habitat Alternative) 64–65 WTGs	Alternative D (Transit Alternative) 78–93 WTGs	Alternative E (Viewshed Alternative) 64–81 WTGs	Alternative F (Higher Capacity Turbine Alternative) 56 WTGs
Cable emplacement/ maintenance	Only small amounts of habitat removal, if any, would be required by onshore power infrastructure construction and would occur in previously disturbed areas. Short-term temporary impacts associated with habitat loss or avoidance during cable emplacement/maintenance may occur, but no injury or mortality of bat individuals would be expected. Cable emplacement/maintenance is therefore expected to have **negligible** adverse impacts on bats.	**Onshore**: The onshore transmission cable route would be located primarily in unvegetated and previously disturbed or developed ROWs that do not provide high-quality habitat for bats; however, some of the alternative routes under consideration within the transmission cable envelope contain segments that would pass through undeveloped, vegetated areas comprised of upland forest and shrubland. The preferred transmission cable route is an approximate 1-mile (1.6-km) route that would predominantly follow along paved roads or previously disturbed areas such as parking lots. Based on Project timing, the limited area of effect relative to available habitat, and the proposed impact avoidance and minimization measures, adverse construction impacts of the Proposed Action on northern long-eared bat would be **negligible** adverse. O&M impacts resulting from vegetation clearing would be reduced by observing time-of-year restrictions on vegetation removal to avoid bats' breeding season and therefore, **negligible** adverse. Impacts from land disturbance during decommissioning would be similar to those described within the construction impact analysis, although the impacts would likely be less because new vegetation clearing and grading would not be necessary. Onshore construction and installation would add to other limited onshore bat habitat disturbance actions through the removal of approximately 1.6 acres (0.6 ha) of mixed oak/white pine forest at the ICF but would not result in population-level effects given the limited amount of habitat removal and the presence of high-quality habitat in the vicinity. Therefore, the cumulative impact of the Proposed Action when combined with past, present, and reasonably foreseeable projects would result in short-term **negligible** to **minor** adverse impacts to bats.	**Onshore**: Alternatives C through F would not alter onshore activities. Therefore, construction, O&M, and decommissioning impacts would be the same as those described for the Proposed Action: short term **negligible** adverse. Likewise, cumulative impacts would be the same as those described for the Proposed Action: short term **negligible** to **minor** adverse impacts.			
Light	Lighting sources on the WTGs and OSSs may serve as an attractant to bats as they navigate, or bats may be indirectly attracted to insect prey drawn to the lights. But based on collision mortalities documented at onshore wind farms, the behavioral vulnerability to collision due to offshore lighting for all bat species would be **negligible** adverse.	**Offshore**: Bats may demonstrate attraction to or avoidance of construction vessels installing offshore facilities. Exposure to vessels and installation infrastructure would be temporally limited to the construction period. Thus, behavioral changes due to lighting on construction vessels would be temporary, and impacts to bats would be **negligible** adverse, with long-distance migratory bats most at risk because they are most likely to seasonally occur in the airspace of the RWF. Lighting during the O&M phase of the Project would be limited, which should reduce insect and potential bat attraction (Stantec 2018). Revolution Wind would comply with FAA (2018) and BOEM (2021c) requirements for lighting while using lighting technology (e.g., low-intensity strobe lights) that minimize impacts on bat species. Overall, collision-related mortality or injury from lighting at the offshore facilities could result in **negligible** to **minor** adverse impacts to bats at the RWF, with long-distance migratory bats most at risk because they are most likely to seasonally occur in the airspace of the RWF. The Proposed Action would add up to 100 new WTGs with red flashing aviation hazard lighting to the offshore environment. Vessel lights during construction and installation, O&M, and decommissioning would be minimal and limited to vessels transiting to and from construction areas. Ongoing and future non–offshore wind activities are expected to cause permanent impacts, primarily driven by light from offshore structures and short-term and localized impacts from vessel lights. For these reasons, the Proposed Action when combined with past, present, and reasonably foreseeable activities would result in long-term **negligible** to **minor** adverse cumulative impacts to bats, with long-distance migratory bats most at risk because they are most likely to seasonally occur in the Lease Area.	**Offshore**: No measurable change from Proposed Action construction impacts is anticipated for Alternatives C through F because the number and duration of construction vessels and work areas requiring nighttime lighting would be the same as described for the Proposed Action. Alternatives C through F would reduce operational nighttime lighting due to a reduced number of lighted structures, thereby negligibly decreasing the risk of bat injury or mortality from collision with WTGs. However, impacts to bats from offshore lighting under these alternatives would likely be the same as those described for the Proposed Action: **negligible** to **minor** adverse. Alternatives C through F would add up 56 to 93 new WTGs with red flashing aviation hazard lighting to the offshore environment. Additionally, marine navigation lighting would include one or more flashing white lights on each WTG and the OSSs and would be directed out and down to the water surface. Vessel lights during construction and installation, O&M, and decommissioning would be minimal and limited to vessels transiting to and from construction areas. These lights could serve as an attractant to bats as they navigate, or bats may be indirectly attracted to insect prey drawn to the lights. Ongoing and future non–offshore wind activities are expected to cause permanent impacts, primarily driven by light from offshore structures and short-term and localized impacts from vessel lights. For these reasons, Alternatives C through F, when combined with past, present, and reasonably foreseeable activities would result in long-term **negligible** to **minor** adverse cumulative impacts to bats, with long-distance migratory bats most at risk because they are most likely to seasonally occur in the Lease Area.			

Impact-Producing Factor	No Action Alternative	Alternative B (Proposed Action) up to 100 WTGs	Alternative C (Habitat Alternative) 64–65 WTGs	Alternative D (Transit Alternative) 78–93 WTGs	Alternative E (Viewshed Alternative) 64–81 WTGs	Alternative F (Higher Capacity Turbine Alternative) 56 WTGs
		Onshore: Most construction activities would occur during the day over the approximately 1-year construction period for the onshore facilities, impacts from lighting on bats would be **negligible** adverse. During the O&M of the OnSS and ICF, general yard lighting would be used for assessment of equipment. In general, lighting would be off at night unless there is work in progress or lights are left on for safety and security purposes. Because the use of lighting at night is expected to be infrequent, the impacts it has on temporary bat displacement and/or behavior disruption would be **negligible** adverse. Lighting from construction and operations could add to baseline light sources and activities associated with other onshore projects. When considered in the context of the other nearby commercial and industrial lighting within the GAA, BOEM expects **negligible** adverse cumulative impacts to bats.	**Onshore**: Alternatives C through F would not alter onshore activities. Therefore, impacts would be the same as those described for the Proposed Action: temporary to short term **negligible** adverse.			
Noise	Anthropogenic noise on the OCS associated with future offshore wind development, including noise from pile driving and construction activities (e.g., use of noise-producing heavy equipment or machinery), could impact bats on the OCS. Construction activity would be short term, temporary, and highly localized; however, no auditory impacts on bats would be expected. Given the temporary and localized nature of potential impacts and bats' expected biologically insignificant response, impacts on bats are expected to be **negligible** adverse. No individual fitness (i.e., a bat's ability to survive and reproduce) or population-level impacts would occur as a result of onshore or offshore noise associated with future offshore wind development.	**Offshore**: Pile-driving noise and offshore construction noise associated with the Proposed Action would be short term, temporary, and highly localized and is expected to result in **negligible** adverse impacts. Increases in activity and associated disturbances during RWF maintenance activities would have a short-term **negligible** adverse impact on bats because of the limited additional vessel activity and low likelihood of bat occurrence near the RWF. There would also be no impacts to bats during O&M of the offshore RWEC because these components are underwater, and there would be no routine maintenance at these components. Pile-driving and other construction noise and activity associated with the Proposed Action would add to baseline noise and activity associated with other offshore wind projects with overlapping construction periods. Therefore, the cumulative impact of the Proposed Action when combined with other past, present, and reasonably foreseeable projects would result in short-term **negligible** to **minor** adverse impacts to bats.	**Offshore**: Alternatives C through F would slightly decrease construction impacts on bats from noise associated with pile driving for WTGs as compared to the Proposed Action. Impacts, if any, would be temporary, limited to behavioral avoidance, and localized and would be the same as those described for the Proposed Action: short term **negligible** adverse. No measurable change from Proposed Action O&M impacts is anticipated because operational noise sources and levels would be the same: short term **negligible** adverse. Pile driving and other construction noise and activity associated with Alternatives C through F would add to baseline noise and activity associated with other offshore wind projects with overlapping construction periods. However, Alternatives C through F's contribution would be limited in duration and cease when construction ends. Therefore, these alternatives when combined with other past, present, and reasonably foreseeable projects would result in short- to long-term **negligible** to **minor** adverse cumulative impacts to bats.			
		Onshore: Some potential for short-term, temporary, and localized habitat impacts arising from onshore construction noise exists; however, no auditory impacts on bats would be expected. Therefore, noise impacts resulting from construction and installation of the onshore facilities would be temporary **negligible** adverse. Most activities would generally not be conducted during the active bat foraging period between twilight and sunrise, thus noise from maintenance activities is not expected to impact bat foraging behavior. Noise and traffic resulting from operation of the onshore facilities would be temporary and **negligible** adverse. Impacts to bats from noise during decommissioning would be similar to that described for construction activities. Construction noise and activities associated with construction and operation of the onshore facilities could add to baseline noise and activity associated with other onshore projects with overlapping construction periods. Normal operation of the OnSS would generate continuous noise, but BOEM	**Onshore**: Alternatives C through F would not alter onshore activities. Therefore, impacts would be the same as those described for the Proposed Action: temporary to long-term **negligible** adverse.			

<table>
<tr><th>Impact-Producing Factor</th><th>No Action Alternative</th><th>Alternative B (Proposed Action)
up to 100 WTGs</th><th>Alternative C
(Habitat Alternative)
64–65 WTGs</th><th>Alternative D
(Transit Alternative)
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(Viewshed Alternative)
64–81 WTGs</th><th>Alternative F
(Higher Capacity Turbine Alternative)
56 WTGs</th></tr>
<tr><td></td><td></td><td>expects long-term negligible adverse associated impacts when considered in the context of the other commercial and industrial noises nearby.</td><td colspan="4"></td></tr>
<tr><td rowspan="2">Presence of structures</td><td rowspan="2">Some habitat conversion may result from port expansion activities required to meet the demands for fabrication, construction, transportation, and installation of wind energy structures. However, the noticeable increase from future offshore wind development would be a minimal contribution in the port expansion required to meet increased commercial, industrial, and recreational demand (BOEM 2019b).
Cave bats rarely occur offshore and given the rarity of tree bats in the offshore environment, the likelihood of exposure of cave and tree bats to construction vessels during construction or maintenance activities, or the RSZ of operating WTGs in the lease areas, is very low. Therefore, related impacts are expected to be negligible adverse.</td><td>Offshore: Exposure to vessels and installation infrastructure would be temporally limited to the construction period. Behavioral vulnerability to collision with construction equipment is expected to be negligible adverse.
Collisions between bats and OSSs could cause injury and/or mortality. However, in general, these objects would not pose a collision risk because of a bat’s ability to echolocate and detect stationary structures (Stantec 2018). Bat activity can be expected to be low during WTG operation and limited to warmer periods in the summer or during fall migration. Thus, the risk of injury and/or mortality to bats would be negligible to minor adverse. The structures associated with the Proposed Action, and the consequential negligible to minor adverse impacts, would remain at least until decommissioning of the Project is complete.
The Project’s contribution to impacts on bats would be limited because migrating bats rarely use the OCS and the Project would account for less than 4% of the total future structures on the OCS. Therefore, the Proposed Action when combined with past, present, and reasonably foreseeable projects would result in long-term negligible to minor adverse cumulative impacts to bats.</td><td colspan="4">Offshore: Alternatives C through F would reduce the number of WTGs, potentially resulting in a reduced amount of offshore construction equipment and vessels required. However, because bat exposure to vessels and installation infrastructure would be temporally limited to the construction period, the behavioral vulnerability to collision with construction equipment under Alternatives C through F is expected to be the same as described for the Proposed Action: short term negligible adverse.
During operation, Alternatives C through F would reduce the number of WTGs as compared to the Proposed Action and potentially allow for improved maneuverability for bats through the Lease Area and negligibly decreases the risk of injury or mortality from collision with WTGs. However, impacts to bats from the presence of structures under these alternatives would not be substantially reduced and would likely be the same as those described for the Proposed Action: long term negligible to minor adverse.
Alternatives C through F would add 56 to 93, additional WTGs and up to two OSSs to the No Action Alternative. Therefore, the total cumulative structures would be 3,066 to 3,103. Impacts to migration patterns or collision risk from these additional turbines would persist until decommissioning is complete. However, the Project’s contribution to impacts on bats would be limited because migrating bats rarely use the OCS and the Project would account for less than 4% of the total future structures on the OCS. Therefore, these alternatives, when combined with past, present, and reasonably foreseeable projects would result in long-term negligible to minor adverse cumulative impacts to bats.</td></tr>
<tr><td>Onshore: Impacts on mortality and injury from the onshore construction operations would be avoided by observing time-of-year restrictions on vegetation removal that would avoid the breeding season of bats (see COP Table ES-1). Therefore, these temporary impacts, if any, from construction equipment and ongoing activity would be negligible adverse.
The OnSS and ICF would be visible structures that would result in permanent bat habitat conversion and loss. Land disturbance as it relates to vegetation clearing may result in the direct injury or mortality of bats. However, mortality and injury risk would be reduced by observing time-of-year restrictions on vegetation removal to avoid bats’ breeding season. Collisions between bats and onshore facilities could cause mortality. However, in general, these objects would likely not pose a collision risk because of a bat’s ability to echolocate and detect stationary structures (Stantec 2018). Therefore, the impacts to bats from the presence of onshore facilities would be long term negligible adverse.
The contribution of the Proposed Action to cumulative impacts would not result in population-level effects given the limited amount of habitat removal and the presence of high-quality habitat in the vicinity. The combined impacts on bats from habitat loss would likely be long term negligible adverse given the limited amount of habitat removal and the presence of high-quality habitat in the vicinity.</td><td colspan="4">Onshore: Alternatives C through F would not alter onshore activities. Therefore, impacts would be the same as those described for the Proposed Action: temporary to long-term negligible adverse.</td></tr>
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3.5.2.2 Alternative B: Impacts of the Proposed Action Alternative on Bats

3.5.2.2.1 Construction and Installation

Offshore Activities and Facilities

Light: Bats may demonstrate attraction to or avoidance of construction vessels installing offshore facilities, particularly if insects (i.e., prey) are drawn to the lights of the vessels (BOEM 2014). Exposure to vessels and installation infrastructure would be temporally limited to the construction period. Thus, behavioral changes due to lighting on construction vessels would be temporary, and impacts to bats would be **negligible** adverse, with long-distance migratory bats most at risk because they are most likely to seasonally occur in the airspace of the RWF.

Noise: Pile-driving noise and offshore construction noise associated with the Proposed Action would be short term, temporary, and highly localized and is expected to result in **negligible** adverse impacts. Auditory impacts are not expected to occur as recent research shows that bats may be less sensitive to temporary threshold shifts than other terrestrial mammals (Simmons et al. 2016). Impacts, if any, would be limited to behavioral avoidance of pile-driving and/or construction activities, and no temporary or permanent hearing loss would be expected (Simmons et al. 2016).

Presence of structures: Bats are expected to seasonally occur in the Lease Area while migrating, commuting, or foraging. Bats were observed roosting aboard support vessels during the construction of the Block Island Wind Farm (Stantec 2016), suggesting the presence of artificial roosting structures may provide some benefit to bats in the offshore environment. Bats are well known for their ability to detect objects with echolocation (Horn et al. 2008; Johnson et al. 2004) and thus are unlikely to collide with stationary structures (Cryan 2011). Further, exposure to vessels and installation infrastructure would be temporally limited to the construction period. Behavioral vulnerability to collision with construction equipment is expected to be **negligible** adverse.

Onshore Activities and Facilities

Cable emplacement/maintenance: The preferred transmission cable route is an approximately 1-mile (1.6-km) route, that would predominantly follow along paved roads or previously disturbed areas such as parking lots that do not provide high-quality habitat for bats. However, some of the alternative routes under consideration within the transmission cable envelope contain segments that would pass through undeveloped, vegetated areas composed of upland forest and shrubland and would be approximately the same length (see Section 3.8). Impacts associated with construction of the onshore transmission cable could occur if construction activities take place during the active season for bats (generally April through October). Such activities may result in injury or mortality of individual bats, particularly juveniles as they are unable to flush from a roost if occupied by bats at the time of removal. However, tree and shrub removal would occur outside the bat roosting period (from May 1 through August 15) when feasible (see COP Table ES-1), thus limiting the potential for direct injury or mortality from the removal of occupied roost trees. There would be some potential for adverse impacts on bats as a result of the loss of potentially suitable roosting and/or foraging habitat, but these impacts would be **negligible** adverse.

BOEM anticipates that **negligible** adverse impacts, if any, would occur with adherence to USFWS northern long-eared bat conservation measures and that **negligible** adverse habitat impacts would not result in individual fitness or population-level effects given the limited amount of habitat removal and the presence of high-quality bat habitat in the vicinity. Based on Project timing, the limited area of effect relative to available habitat, and the proposed impact avoidance and minimization measures, adverse impacts of the Proposed Action on northern long-eared bat would be **negligible** adverse. A detailed impacts analysis to northern long-eared bats from Project construction activities is provided in the USFWS BA (BOEM 2022).

Light: Some overnight lighting would occur during construction of the onshore facilities. Wildlife typically not exposed to light, such as bats, may behave differently if exposed to light at nighttime. Because most construction activities would occur during the day over the approximately 1-year construction period for the onshore facilities, impacts from lighting on bats would be **negligible** adverse.

Noise: Some potential for short-term, temporary, and localized habitat impacts arising from onshore construction noise exists; however, no auditory impacts on bats would be expected. As discussed with offshore construction noise, recent literature suggests that bats are less susceptible to temporary or permanent hearing loss from exposure to intense sounds (Simmons et al. 2016). Based on available information discussed in Section 3.5.1.1, noise impacts resulting from construction and installation of the onshore facilities would be temporary **negligible** adverse.

Presence of structures: Visible structures (i.e., construction equipment) would be present during construction of the onshore facilities. Collisions between bats and vehicles or construction equipment could cause injury and/or mortality. However, in general, these objects would not pose a collision risk because of a bat's ability to echolocate and detect stationary structures (Stantec 2018). The operational footprints of the OnSS and ICF would result in habitat loss when forested upland is cleared and replaced with hard structures and crushed gravel yards. The ICF would result in a loss of approximately 1.6 acres (0.6 ha) of mixed oak/white pine forest, which is reflective of the operational footprint of the ICF. The OnSS would create a loss of 3.8 acres (1.5 ha) of mixed oak/white pine forest and 0.6 acre (0.2 ha) of ruderal pitch pine barren. Together, these losses represent a relatively small fraction of the 52 acres (21 ha) of contiguous bat habitat identified in the *Rhode Island Wildlife Action Plan* (RIWAP) (vhb 2021). Impacts on mortality and injury from the onshore construction operations would be avoided by observing time-of-year restrictions on vegetation removal that would avoid the breeding season of bats (see COP Table ES-1). Therefore, these temporary impacts, if any, from construction equipment and ongoing activity would be **negligible** adverse.

3.5.2.2.2 Operations and Maintenance and Decommissioning

Offshore Activities and Facilities

Light: Lighting sources on the WTGs and OSSs may serve as an attractant to bats as they navigate, or bats may be indirectly attracted to insect prey drawn to the lights. However, bats do not appear to be as susceptible to these types of collision risks as some birds (Stantec 2018), and aviation lighting has not been found to influence bat collision risk at onshore facilities in North America (Arnett et al. 2008). Lighting during the O&M phase of the Project would be limited, which should reduce insect and potential bat attraction (Stantec 2018). Revolution Wind would comply with FAA (2018) and BOEM (2021c) requirements for lighting while using lighting technology (e.g., low-intensity strobe lights) that minimize impacts on bat species. Overall, collision-related mortality or injury from lighting at the offshore facilities could result in **negligible** to **minor** adverse impacts to bats at the RWF, with long-distance migratory bats most at risk because they are most likely to seasonally occur in the airspace of the RWF.

Noise: Boat activity and noise already occur within and adjacent to the Lease Area based on existing levels of vessel traffic, as described in Section 3.16. Increases in activity and associated disturbances during RWF maintenance activities would have a short-term **negligible** adverse impact on bats because of the limited additional vessel activity and low likelihood of bat occurrence near the RWF. There would also be no impacts to bats during O&M of the offshore RWEC because these components are underwater, and there would be no routine maintenance at these components.

Presence of structures: During Project O&M, injury or mortality from collision with WTGs represents the greatest potential risk to bats. WTGs and other offshore facilities may also provide roosting opportunities for bats. Collisions between bats and OSSs could cause injury and/or mortality. However, in general, these objects would not pose a collision risk because of a bat's ability to echolocate and detect stationary structures (Stantec 2018). Additionally, individual bats could collide with WTGs, resulting in mortality or injury. It is difficult to confirm bat fatalities at offshore WTGs; however, offshore bat occurrences are infrequent and primarily seasonal (during migration), and activity declines as the distance from shore increases. Existing data from meteorological buoys provide the best opportunity to further define bat use of open-water habitat far from shore where Project WTGs are proposed. Relatively few bat passes were detected at meteorological buoy sites, and use was sporadic when compared to sites on offshore islands (Stantec 2016). In general, the bat species assessed are not expected to regularly forage in the Lease Area, but some may be present during migration, particularly in the fall (BOEM 2012; Stantec 2018).

Specific weather conditions may contribute to bat mortality from turbines. Mortality data from onshore wind farms indicate that bat collision mortality is expected to occur mainly on nights with calm winds during migratory periods as relatively more bats are migrating at greater altitudes in favorable conditions (Arnett et al. 2008). Likewise, coastal and offshore acoustic studies (Stantec 2016) found that greater wind speeds and cool temperatures have an adverse effect on bat activity. However, during fall migration, bats may take advantage of favorable wind directions and may be more likely to fly during colder weather (Stantec 2016). Most offshore bat activity took place at wind speeds less than 5 m/s. Because average wind speeds in the Lease Area are between 5 and 10 m/s, with stronger wind in the winter, bat activity can be expected to be low during WTG operation and limited to warmer periods in the summer or during fall migration. Thus, the risk of injury and/or mortality to bats would be **negligible** to **minor** adverse. The structures associated with the Proposed Action, and the consequential **negligible** to **minor** adverse impacts, would remain at least until decommissioning of the Project is complete. Impacts from O&M of the RWF to the listed northern long-eared bat are not expected because of their low collision risk and the rarity of their occurrence offshore. A detailed impacts analysis to northern long-eared bats from Project operation and decommissioning is provided in the USFWS BA (BOEM 2022).

Onshore Activities and Facilities

Cable emplacement/maintenance: Hazard tree removal would be performed on a cyclical basis to inspect and remove trees that may fall that are outside the edge of the maintained ROW. However, mortality and injury risk would be reduced by observing time-of-year restrictions on vegetation removal to avoid bats' breeding season. Therefore, the impacts resulting from vegetation clearing would be **negligible** adverse. Impacts from land disturbance during decommissioning would be similar to those described within the construction impact analysis, although the impacts would likely be less because new vegetation clearing and grading would not be necessary.

Light: During the O&M of the OnSS and ICF, general yard lighting would be used for assessment of equipment. In general, lighting would be off at night unless there is work in progress or lights are left on for safety and security purposes. Insect prey could be drawn in by lighting at the OnSS and ICF and thus attract foraging bats. However, the surrounding area is currently developed, and lighting-related effects would be abated using minimum-intensity and motion-activated lighting and shielding and downward angling light sources where practicable. As during construction of the onshore facilities, lighting at night has the potential to temporarily displace bats and/or disrupt normal behavior. Because the use of lighting at night is expected to be infrequent, the impacts it has on temporary bat displacement and/or behavior disruption would be **negligible** adverse.

Noise: According to vhb's onshore acoustic assessment (vhb 2021), during O&M, the proposed OnSS and ICF would introduce new sources of sound, which are modeled to be 45.5 A-weighted decibels (dBA) equivalent sound level (Leq) or less when measured at the nearest anthropogenic sensitive receptors and fall within the ambient sound range measured at baseline conditions. Temporary noise and construction-related traffic may occasionally be generated due to nonroutine maintenance. Pickup trucks may be used to make routine visits to the OnSS and ICF during O&M. Occasional O&M emergency visits may necessitate bucket trucks, cranes, and similar vehicles. Infrequent vehicle usage within the OnSS and ICF may create temporary noise-related disturbance to bats adjacent to the OnSS. However, most activities would generally not be conducted during the active bat foraging period between twilight and sunrise, thus noise from maintenance activities is not expected to impact bat foraging behavior. Luo et al. (2014) demonstrated that bat response to traffic noise was low relative to other stimuli (e.g., colony noise, vegetation) and that bats rapidly habituate to prolonged noise disturbance. Based on this available information, noise and traffic resulting from operation of the onshore facilities would be temporary and **negligible** adverse. Impacts to bats from noise during decommissioning would be similar to that described for construction activities.

Presence of structures: The OnSS and ICF would be visible structures that would result in permanent bat habitat conversion and loss. Land disturbance in the form of vegetation management would occur on a periodic basis to maintain vegetation at shrub height within the operational footprint of the onshore facilities. Land disturbance as it relates to vegetation clearing may result in the direct injury or mortality of bats. However, mortality and injury risk would be reduced by observing time-of-year restrictions on vegetation removal to avoid bats' breeding season. Collisions between bats and onshore facilities could cause mortality. However, in general, these objects would likely not pose a collision risk because of a bat's ability to echolocate and detect stationary structures (Stantec 2018). Therefore, the impacts to bats from the presence of onshore facilities would be long term **negligible** adverse**.**

3.5.2.2.3 Cumulative Impacts

Offshore Activities and Facilities

Lighting: The Proposed Action would add up to 100 new WTGs with red flashing aviation hazard lighting to the offshore environment. Additionally, marine navigation lighting would include multiple flashing white lights on each WTG and the OSSs and would be directed out and down to the water surface. Vessel lights during construction and installation, O&M, and decommissioning would be minimal and limited to vessels transiting to and from construction areas. These lights could serve as an attractant to bats as they navigate, or bats may be indirectly attracted to insect prey drawn to the lights.

However, the lack of bat carcasses reported during large-scale bird-related fatality events at illuminated lighthouses, lightships, and oil or research platforms indicates that bats do not appear to be as susceptible to these types of collision risks as some birds (Stantec 2018). As such, ongoing and future non–offshore wind activities are expected to cause permanent impacts, primarily driven by light from offshore structures and short-term and localized impacts from vessel lights. For these reasons, the Proposed Action when combined with past, present, and reasonably foreseeable activities would result in long-term **negligible** to **minor** adverse cumulative impacts to bats, with long-distance migratory bats most at risk because they are most likely to seasonally occur in the Lease Area.

Noise: Pile-driving and other construction noise and activity associated with the Proposed Action would add to baseline noise and activity associated with other offshore wind projects with overlapping construction periods. However, the Proposed Action's contribution to noise impacts would be limited in duration and cease when construction ends. Therefore, the cumulative impact of the Proposed Action when combined with other past, present, and reasonably foreseeable projects would result in short-term **negligible** to **minor** adverse impacts to bats.

Presence of structures: The Proposed Action would add up to 100 additional WTGs and up to two OSSs to the No Action Alternative. Therefore, the total cumulative structures would be 3,110. Impacts to migration patterns or collision risk from these additional turbines would persist until decommissioning is complete. However, the Project's contribution to impacts on bats would be limited because migrating bats rarely use the OCS and the Project would account for less than 4% of the total future structures on the OCS. Therefore, the Proposed Action when combined with past, present, and reasonably foreseeable projects would result in long-term **negligible** to **minor** adverse cumulative impacts to bats.

Onshore Activities and Facilities

Cable emplacement/maintenance: The transmission cable envelope contains approximately 0.56 acre (0.22 ha) of mixed oak/white pine forest, 0.32 acre of softwood forest, 0.02 acre of ruderal grassland/shrubland, 0.008 acre of oak forest, and 0.006 acre of pitch pine barren (see Section 3.8). Onshore construction and installation would add to other limited onshore bat habitat disturbance actions. Land disturbance associated with cable emplacement could result in the loss of potentially suitable roosting and/or foraging habitat for bats. However, the preferred transmission cable route is an approximate 1-mile (1.6-km) route that would predominantly follow along paved roads or previously disturbed areas such as parking lots. Further, Revolution Wind and other future land developers would adhere to USFWS northern long-eared bat conservation measures. As a result, cumulative impacts would not result in population-level effects given the limited amount of habitat removal and the presence of high-quality habitat in the vicinity. Therefore, the cumulative impact of the Proposed Action when combined with past, present, and reasonably foreseeable projects would result in short-term **negligible** to **minor** adverse impacts to bats.

Light: The Proposed Action would involve the use of some overnight lighting during construction and installation and during O&M and decommissioning of the onshore facilities. O&M lighting of facilities would be switch activated and would only occur when O&M activities are ongoing. Lighting from construction and operations could add to baseline light sources and activities associated with other onshore projects. Because the use of lighting at night is expected to be infrequent, the impacts it has on temporary bat displacement and/or behavior would be short term **negligible** adverse. When considered in the context of the other nearby commercial and industrial lighting within the GAA, BOEM expects **negligible** adverse cumulative impacts to bats.

Noise: Construction noise and activities associated with construction and operation of the onshore facilities could add to baseline noise and activity associated with other onshore projects with overlapping construction periods. However, the Proposed Action's incremental contribution would be **negligible** adverse as it would be limited in duration and cease when construction ends. No individual fitness or population-level effects would be expected. Normal operation of the OnSS would generate continuous noise, but BOEM expects long-term **negligible** adverse associated impacts when considered in the context of the other commercial and industrial noises nearby.

Presence of structures: Onshore construction and installation would add to other limited onshore bat habitat disturbance actions through the removal of approximately 1.6 acres (0.6 ha) of mixed oak/white pine forest at the ICF. The OnSS would create a loss of 3.8 acres (1.5 ha) of mixed oak/white pine forest. This land disturbance could result in the loss of potentially suitable roosting and/or foraging habitat for bats. However, Revolution Wind and other future land developers would adhere to USFWS northern long-eared bat conservation measures, which would also minimize impacts to other roosting/foraging bat species. As a result, the contribution of the Proposed Action to cumulative impacts would not result in population-level effects given the limited amount of habitat removal and the presence of high-quality habitat in the vicinity. The combined impacts on bats from habitat loss would likely be long term **negligible** adverse given the limited amount of habitat removal and the presence of high-quality habitat in the vicinity. Collisions between bats and structures have some limited potential to cause mortality. However, in general, these objects would not pose a collision risk because of a bat's ability to echolocate and detect stationary structures and therefore would not contribute to cumulative impacts to bats.

3.5.2.2.4 Conclusions

In summary, construction and installation, O&M, and decommissioning of the Proposed Action would have **negligible** to **minor** adverse impacts on bats, especially if conducted outside the active season. The main significant risk would be from operation of the offshore WTGs, which could lead to long-term **negligible to minor** adverse impacts in the form of collision-related mortality, although BOEM anticipates this to be rare. In the context of reasonably foreseeable environmental trends in the area, impacts of individual IPFs resulting from ongoing and planned actions, including the Proposed Action, would be **negligible** to **minor** adverse. Considering all the IPFs together, BOEM anticipates that the impacts from ongoing and planned actions, including the Proposed Action, would result in **negligible** to **minor** adverse impacts on bats in the GAA because of ongoing climate change, interactions with operating WTGs on the OCS, and onshore habitat loss. Future offshore wind activities are not expected to materially contribute to the IPFs discussed above. Given the infrequent and limited anticipated use of the OCS by migrating tree bats during spring and fall migration and that cave bats do not typically occur on the OCS, the IPFs associated with future offshore wind activities that occur offshore would not be expected to appreciably contribute to overall impacts on bats. Some potential for temporary disturbance and permanent loss of onshore habitat may occur as a result of future offshore wind development. However, habitat removal is anticipated to be minimal, and any impacts resulting from habitat loss or disturbance would not be expected to result in individual fitness or population-level effects within the GAA. The Proposed Action would contribute to the overall impact rating primarily through the permanent impacts due to onshore habitat loss. Thus, the overall impacts on bats would be **minor** adverse because limited impacts are expected due to the minimal presence of bats within the Lease Area and bat populations would recover completely.

3.5.2.3 Alternatives C, D, E, and F

Table 3.5-1 provides a summary of IPF findings for these alternatives.

3.5.2.3.1 Conclusions

Alternatives C through F would reduce the number of WTGs, which subsequentially would reduce the potential collision risk for bats. Still, BOEM expects the overall impacts of these alternatives to bats would be similar to the Proposed Action: **negligible** to **minor** adverse.

In the context of other reasonably foreseeable environmental trends and planned actions, BOEM also expects that Alternatives C through F's contribution to the cumulative impacts would be similar to the Proposed Action (ranging from **negligible** to **minor** adverse, depending on the IPF). The overall impacts of Alternatives C through F when combined with past, present, and reasonably foreseeable activities would therefore be the same as under the Proposed Action: **minor** adverse.

3.5.2.4 Mitigation

Conducting marine construction activities during approved in-water work windows, which would be developed in consultation with NMFS and USFWS, could further reduce the expected negligible to minor long-term impacts on bats (see Table F-2 in Appendix F for details). Implementation of Revolution Wind's *Avian and Bat Post-Construction Monitoring Framework* (see Appendix G and COP Appendix AA) would not reduce impacts; however, the data gathered from the monitoring would be used to evaluate impacts and potentially lead to additional mitigation measures, if required (30 CFR 585.633(b)). If the reported postconstruction bird and bat monitoring results indicate that bird and bat impacts deviate substantially from the impact analysis included in this EIS, then Revolution Wind would be required to recommend new mitigation measures or monitoring methods.

3.6 Benthic Habitat and Invertebrates (see section in main EIS)

3.7 Birds

3.7.1 Description of the Affected Environment and Environmental Consequences of the No Action Alternative for Birds

Geographic Analysis Area: The GAA for birds is the United States coastline from Maine to Florida (Figure 3.7-1). The offshore limit is 100 miles (160.9 km) from the Atlantic coast to capture the migratory movements of most species in this group. The onshore limit is 0.5 mile (0.8 km) inland from the Atlantic coast to cover onshore habitats used by the species that may be affected by offshore components of the Project as well as those species that could be affected by onshore Project components. The GAA was established to capture resident species and migratory species that winter as far south as South America and the Caribbean and those that breed in the Arctic or along the Atlantic coast that travel through the area.

Affected Environment: Table A.8.3-1 in Appendix A of the Vineyard Wind 1 final EIS (BOEM 2021a), the SFWF final EIS (BOEM 2021b), and COP Appendix AA (bri 2021), all incorporated here by reference, describe baseline conditions and the impacts, based on IPFs assessed, of ongoing and future activities other than offshore wind. These are further discussed below in the context of this Project. This section addresses potential impacts on bird populations that use inland, coastal, and offshore habitats, including both resident birds that use the Lease Area during all of (or portions of) the year and migrating birds with the potential to pass through the Lease Area during fall and/or spring migrations. Detailed information regarding species potentially present can be found in COP Appendix AA (bri 2021) and COP Appendix K (vhb 2021). Given the differences in life history characteristics and habitat use between offshore, inland, and coastal bird species, the sections below provide a separate discussion of each group. This section also discusses migratory birds as well as bald and golden eagles. In addition, this section addresses federally listed threatened and endangered species, but further information is provided in the Project BA prepared for the USFWS (BOEM 2022). Unless stated otherwise, special-status bird species are expected to be impacted similarly as described in general for other birds.

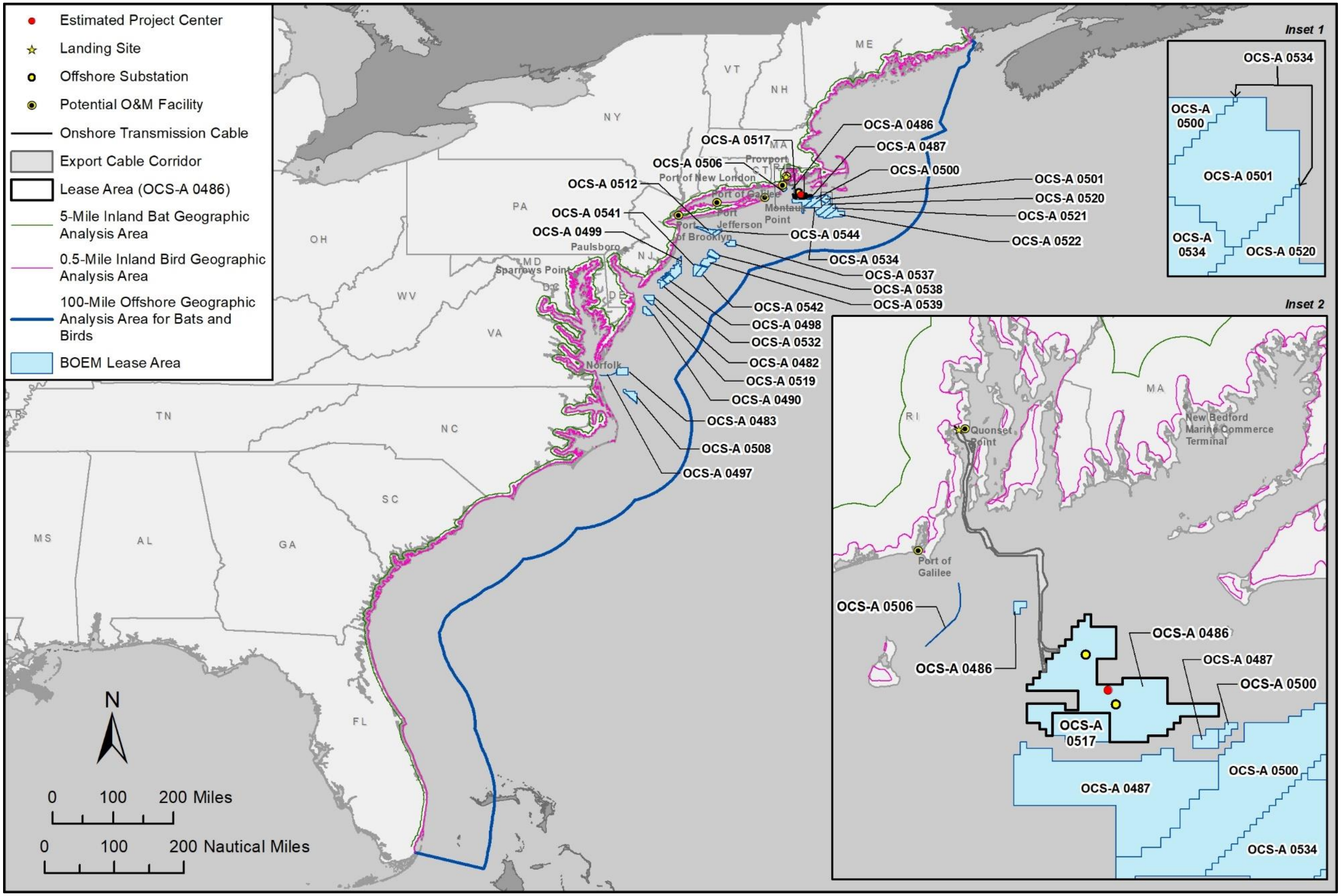

Figure 3.7-1. Geographic analysis area for birds.

Migrating Birds

The Atlantic Flyway, which follows the U.S. Atlantic coast, is an important migration route for many bird species moving from breeding grounds in New England and eastern Canada to winter habitats in North, Central, and South America. Bays, beaches, coastal forests, marshes, and wetlands provide important stopover and foraging habitat for migrating birds (MMS 2007). Both the onshore and offshore facilities associated with the Proposed Action are located within the Atlantic Flyway. Bird species using this flyway during spring and fall migrations have the potential to encounter proposed Project facilities. Despite the level of human development and activity present, the mid-Atlantic coast plays an important role in the ecology of many bird species. Chapter 4.2.9.3 of the Atlantic OCS EIS/EA (BOEM 2014a), incorporated here by reference, discusses the use of Atlantic coast habitats by migrating birds.

All native birds (except certain game birds protected under state laws) are protected under the Migratory Bird Treaty Act of 1918 (MBTA). The official list of migratory birds protected under the MBTA, and the international treaties that the MBTA implements, is found at 50 CFR 10.13. The MBTA makes it illegal to "take" migratory birds, their eggs, feathers, or nests.[1] Under Section 3 of Executive Order 13186, BOEM and the USFWS established an MOU on June 4, 2009, which identifies specific areas in which cooperation between the agencies would substantially contribute to the conservation and management of migratory birds and their habitats (MMS and USFWS 2009). The purpose of the MOU is to strengthen migratory bird conservation through enhanced collaboration between the agencies. One of the underlying tenets identified in the MOU is to evaluate potential impacts to migratory birds and design or implement measures to avoid, minimize, and mitigate such impacts as appropriate (MMS and USFWS 2009:Sections C, D, E(1), F(1–3, 5), G(6)).

Within the Atlantic Flyway, much of the bird migration activity is concentrated along the coastline (Watts 2010). Waterbirds use a corridor between the coast and several miles out onto the Atlantic OCS, whereas land birds tend to use a wider corridor extending from the coastline to tens of miles inland (Watts 2010). Although both groups may occur over land or water within the Atlantic Flyway and may extend considerable distances from shore, the highest diversity and density are centered on the shoreline. Migrating terrestrial species using the Atlantic Flyway may follow the coastline during migration or use more direct flight routes over expanses of open water. Many marine birds also make annual migrations up and down the eastern seaboard (e.g., gannet, loon, and sea ducks), taking them directly through the northeastern region in spring and fall. This results in a complex ecosystem where the community composition shifts regularly and where temporal and geographic patterns are highly variable. The region supports large populations of birds in summer, some of which breed in the area (e.g., coastal gulls and terns). Other summer residents (e.g., shearwaters and storm-petrels) visit from the Southern Hemisphere (where they breed during the austral summer). In the fall, many of the summer residents leave the area and migrate south to warmer regions and are replaced by species that breed farther north and winter in the northeastern region of the United States.

BOEM funds scientific studies and partners with the USFWS to better understand how migratory birds use the Atlantic OCS and to refine the understanding of the risks from development to migratory species (BOEM 2020). BOEM uses information from these studies, the USFWS, and the scientific literature to

[1] As described under 50 CFR 10.12, "Take means to pursue, hunt, shoot, wound, kill, trap, capture, or collect, or attempt to pursue, hunt, shoot, wound, kill, trap, capture, or collect."

avoid leasing areas with high concentrations of migratory birds that are most vulnerable to offshore wind development. In addition, BOEM's stakeholder engagement during the delineation of the adjacent MA WEA resulted in the exclusion of 14 Atlantic OCS blocks that overlapped with high value sea duck habitat (BOEM 2013). BOEM worked with the USFWS to develop standard operating conditions for commercial leases and terms and conditions of plan approval that are intended to ensure that the potential for adverse impacts on birds is minimized. The standard operating conditions have been analyzed in recent EAs, consultations for lease issuance and site assessment activities, and BOEM's recent approval of the Virginia Offshore Wind Technology Advancement Project (BOEM 2015). Some of the standard operating conditions originated from BMPs in the ROD for the 2007 *Programmatic Environmental Impact Statement for Alternative Energy Development and Production and Alternate Use of Facilities on the Outer Continental Shelf, Final Environmental Impact Statement* (MMS 2007:Section 2.7). BOEM and the USFWS will continue to work with lessees to develop postconstruction plans (e.g., those developed for the Vineyard Wind 1 final EIS (BOEM 2021a) and the SFWF final EIS (BOEM 2021b) aimed at monitoring the effectiveness of mitigative measures considered necessary to minimize impacts to migratory birds with the flexibility to consider the need for modifications or additions to the measures.

Regional Offshore and Inland Birds

The Lease Area is located within the Mid-Atlantic Bight, an oceanic region spanning Cape Cod, Massachusetts, to Cape Hatteras, North Carolina. A broad group of bird species may pass through the Lease Area and surrounding area, including migrants (e.g., raptors and songbirds), coastal birds (e.g., shorebirds, waterfowl, and waders), and marine birds (e.g., seabirds and sea ducks). See Table 3-1 in COP Appendix AA for a list of species that may pass through the Lease Area (bri 2021). A high diversity of marine birds uses the Lease Area because it is located at the northern end of the Mid-Atlantic Bight, which overlaps northern and southern species assemblages (bri 2021). Avian surveys were conducted within the Rhode Island Ocean Special Area Management Plan (OSAMP) study area, which included approximately 1,467 square miles (3,800 square kilometers [km^2]) with areas of the Block Island Sound, Rhode Island Sound, and the Atlantic continental shelf (Winiarski et al. 2012). Several methods were used to quantify the distributions and abundances of birds in the OSAMP study area, including land-based surveys, boat-based surveys, and aerial surveys. Survey data show that the use of these waters by coastal and marine birds is heaviest during winter months, peaking in early March to mid-April as birds prepare for and begin their spring migration. In general, coastal waters of less than 65.5 feet (20 m) in depth are important foraging habitat for diving ducks in winter, and nearshore shallow waters are important foraging habitat for locally breeding terns during summer months. Passerines use the air space during migration periods, and Block Island is an important stopover and resting spot for many species. Figures 3-7, 3-10, 3-12, and 3-13 in the Project's COP (bri 2021:Appendix AA) depict shorebirds; herons and egrets; songbirds; and coastal ducks, geese, swans, and grebes observed by season during OSAMP surveys, respectively.

The Marine-life Data and Analysis Team (MDAT) bird models (Curtice et al. 2019; Winship et al. 2018) describe regional-scale patterns of abundance with a range of environmental variables to produce long-term average annual and seasonal models. The MDAT Version 2 relative abundance and distribution models were produced for 47 bird species using U.S. Atlantic waters from Florida to Maine and thus provide an excellent regional context for local relative densities estimated from OSAMP surveys (see Part IV of COP Appendix AA) (bri 2021). Overall, the MDAT models indicate avian abundance is greater closer to shore than in the Lease Area (see Figure 3-6 in COP Appendix AA) (bri 2021).

A variety of passerines and other birds migrate along the Atlantic coast and could fly over the onshore facilities' locations. Although most of the U.S. coastline is disturbed from previous anthropogenic uses, there are several different key habitats present that are suitable to a range of wildlife species. Bird species observed during field investigations and a list of birds that could occur based on habitat preferences within the GAA are listed in Tables C-1 through C-3 in Appendix C in COP Appendix K (vhb 2021).

Overall, birds in the northeastern United States are subject to pressure from ongoing activities, particularly accidental releases of fuel/fluids/hazardous materials (hazmat), sediment, and/or trash and debris; new cable emplacement; interactions with fisheries and fishing gear; and climate change. More than one-third of bird species that occur in North America (37%, 432 species) are at risk of extinction unless significant conservation actions are taken (North American Bird Conservation Initiative [NABCI] 2016). This is likely representative of the conditions of birds within the GAA. The northeastern United States is also home to more than one-third of the human population of the nation. As a result, species that live or migrate through the Atlantic Flyway have historically been, and will continue to be, subject to a variety of ongoing anthropogenic stressors, including hunting pressure (approximately 86,000 sea ducks harvested annually [Roberts 2019]), commercial fisheries bycatch (approximately 2,600 seabirds killed annually on the Atlantic [Hatch 2017; Sigourney et al. 2019]), and climate change, all of which have the potential to adversely impact bird species. According to the NABCI, more than half of the offshore bird species (57%, 31 species) have been placed on the NABCI watch list because of their small ranges, small and declining populations, and threats to required habitats (NABCI 2016). Globally, monitored offshore bird populations have declined by nearly 70% from 1950 to 2010, which may be representative of the overall population trend of seabirds (Paleczny et al. 2015) that may forage, breed, and migrate over the Atlantic OCS. Overall, offshore bird populations are decreasing, although considerable differences in population trajectories of offshore bird families have been documented (NABCI 2016).

Coastal birds, especially those that nest in coastal marshes and other low-elevation habitats, are vulnerable to the rising sea level and the increasing frequency of strong storms due to global warming. According to the NABCI, nearly 40% of the more than 100 bird species that rely on coastal habitats for breeding or migration are on the NABCI watch list. Many of these coastal species have small population sizes and/or restricted distributions, resulting in an increased vulnerability to habitat loss/degradation and other stressors (NABCI 2016). These ongoing impacts on birds would continue regardless of the offshore wind industry. Some of the main drivers of bird population declines include habitat loss, habitat fragmentation, collisions with glass windows and power lines, invasive species, predators, toxic chemicals, and climate change (Mass Audubon 2011, 2013, 2017).

Avian exposure assessments for the Project were conducted for species-season combinations using MDAT and/or OSAMP data (bri 2021). To assess bird exposure at the local (i.e., MI/RI WEA) and regional scales (i.e., U.S. Atlantic waters), the Lease Area was compared to other similarly sized areas in each dataset for each season and species. Estimated exposure for each season and species was given a final score (see Table 3-4 in bri [2021]), which was categorized as minimal (a combined score of 0), low (combined score of 1–2), medium (combined score of 3–4), or high (combined score of 5–6). The exposure scores for each species and season, as well as the aggregated scores (e.g., the annual scores for each species and taxonomic group), should be interpreted as a measure of the relative importance of the Lease Area for a species/group, as compared to other surveyed areas in the region and in the northwest Atlantic. Qualitative exposure determinations were developed using the quantitative assessment of exposure (described above), other locally available data, existing literature, and species accounts. Maps showing the results of the exposure assessment can be found in Part VI of COP Appendix AA (bri 2021).

The Lease Area is generally far enough offshore as to be beyond the range of most breeding terrestrial or coastal bird species. Coastal birds that may forage in the Lease Area occasionally, visit the area sporadically, or pass through on their spring and/or fall migrations include shorebirds (e.g., sandpipers, plovers), waterbirds (e.g., cormorants, grebes), waterfowl (e.g., scoters, mergansers), wading birds (e.g., herons, egrets), raptors (e.g., falcons, eagles), and songbirds (e.g., warblers, sparrows). Overall, except for migratory falcons and songbirds, coastal birds are considered to have minimal exposure to the Lease Area. Falcons, primarily peregrine falcons (*Falco peregrinus*), may be exposed to the Lease Area. Of the marine birds, loons, sea ducks, gulls, terns, and auks received up to a medium overall exposure assessment. Some migratory songbirds, particularly blackpoll warblers (*Setophaga striata*), may also be exposed to the Lease Area during fall migration (bri 2021).

Special-Status Species

Three bird species listed under the ESA are present in the region: piping plover (*Charadrius melodus*) (threatened), red knot (*Calidris canutus rufa*) (threatened), and roseate tern (*Sterna dougallii*) (endangered). The Atlantic population of piping plover nests on beaches in the northeastern U.S. coastal region and will also migrate (spring and fall) through the Lease Area to and from breeding sites. Red knots winter in southern states or in Central or South America and may pass through the Lease Area during migration (spring and fall) in transit to and from Arctic breeding sites. Roseate terns also migrate through the Lease Area in the spring and fall on their way to and from breeding sites in New York, the New England states, and Atlantic Canada. BOEM has prepared a BA to address Project effects to federally listed species under the jurisdiction of the USFWS, pursuant to Section 7 of the ESA (BOEM 2022). The BA also provides detailed accounts for each of these species.

To assess if any special-status species have the potential to occur in the onshore portion of the Lease Area, information from the Rhode Island Department of Environmental Management (DEM) Environmental Resource Map (ERM) was evaluated and an official species list from the USFWS IPaC tool was generated on September 28, 2019, regarding the landfall envelope, the onshore transmission cable routes, the OnSS, and the interconnection cable route (vhb 2021). vhb utilized the IPaC tool to generate lists of bird species protected under the MBTA that have been designated as Birds of Conservation Concern (BCC) by the USFWS within the proposed limits of the onshore facilities during development of the *Onshore Natural Resources and Biological Assessment* (vhb 2021). BCC are those species that without additional conservation actions are likely to become candidates for listing under the ESA (USFWS 2021). Table 4 in Appendix K of the COP (vhb 2021) provides the list of BCC with the potential to occur within the limits of the onshore facilities and indicates which of these species were observed during field investigations. According to the Rhode Island DEM ERM, there are no records of state-listed species within the GAA (vhb 2021). Migratory bird species with potential to occur near proposed onshore facilities are also presented in Table 4 of COP Appendix K (vhb 2021).

Bald and Golden Eagles

Eagles have additional federal protection (besides under the MBTA) under the Bald and Golden Eagle Protection Act. The general morphology of both bald eagles (*Haliaeetus leucocephalus*) and golden eagles (*Aquila chrysaetos*) dissuades long-distance movements in offshore settings (Kerlinger 1985).

These two species generally rely upon thermal formation, which develops poorly over the open ocean, during long-distance movements. The bald eagle is present year-round in Massachusetts and Rhode Island, and its numbers have been slowly increasing over approximately the last 30 years. They are rarely observed in offshore surveys (Williams et al. 2015; all observations < 3.7 miles [6 km] from shore), which supports the notion that bald eagles do not venture far from land. Although bald eagles could be present near the proposed onshore facilities and would most likely be present in late April, no bald eagles were observed during field investigations (vhb 2021). Bald and golden eagles are not expected to occur within the Lease Area, but some potential exists for effects (e.g., displacement due to noise, habitat loss/modification, and injury/mortality due to contact with construction equipment) resulting from the construction and installation, O&M, and decommissioning of the onshore facilities.

3.7.1.1 Future Offshore Wind Activities (without Proposed Action)

This section discloses potential bird impacts associated with future offshore wind development. Analysis of impacts associated with ongoing activities and future non–offshore wind activities is provided in Appendix E1.

<u>Accidental releases and discharges:</u> Future offshore wind and non-wind activities could expose coastal offshore waters to contaminants (e.g., fuel, sewage, solid waste, or chemicals, solvents, oils, or grease from equipment) in the event of a spill or release during routine vessel use. Ingestion of hard and soft plastic debris could lead to blockages and could result in adverse health effects to birds, such as decreased hematological function, dehydration, drowning, hypothermia, starvation, weight loss, and even death (Briggs et al. 1997; Haney et al. 2017; Paruk et al. 2016). Vessel compliance with USCG regulations would minimize trash or other debris; therefore, BOEM expects accidental trash releases from offshore wind vessels to be rare. Spills could result in small exposures that cause oiling of feathers that can lead to adverse effects such as changes in flight efficiencies and result in increased energy expenditure during daily and seasonal activities (Maggini et al. 2017). All future offshore wind projects would be required to comply with regulatory requirements related to the prevention and control of accidental spills administered by the USCG and BSEE. OSRPs are required for each project and would provide for rapid spill response, cleanup, and other measures that would help to minimize potential impacts on affected resources from spills. WTGs and OSSs are generally self-contained and would not generate discharge (see COP Appendix D). Vessels would also have onboard containment measures that would further reduce the impact of a spill in the event of an allision or collision. Based on the low risk of spills from vessels due to implementation of safe handling, storage, and cleanup procedures, impacts from accidental spills and trash would represent a **negligible** adverse impact to birds.

<u>Anchoring and new cable emplacement/maintenance:</u> A small amount of infrequent construction impacts associated with onshore power infrastructure would be required over the next 6 to 10 years to tie future offshore wind energy projects to the electric grid. Typically, this would require only small amounts of habitat removal, if any, and would occur primarily in previously disturbed areas. Up to 23,745 acres of localized temporary seafloor disturbance and associated increased suspended sedimentation could occur during construction of proposed wind farm cables (see Table E-4 in Appendix E). Where future offshore wind activities overlap the GAA, there would be increased anchoring of vessels during survey activities and during the construction and installation, O&M, and decommissioning of offshore components. In addition, there could be increased anchoring/mooring of meteorological (met) towers or buoys. Disturbed seafloor from construction of future offshore wind projects and anchoring may affect diving birds'

foraging success or may affect some prey species (e.g., benthic assemblages); however, impacts would be temporary and localized, and birds would be able to successfully forage in adjacent areas and would not be affected by increased suspended sediments and no population-level impacts would occur. Suspended sediment concentrations during activities other than dredging would be within the range of natural variability for this location. Therefore, adverse impacts would be **minor**. See Sections 3.6 and 3.13 for detailed information on potential effects to benthic habitat.

Climate change: Impacts associated with climate change (i.e., increased storm severity and frequency, ocean acidification, altered migration patterns, increased disease frequency, habitat conversion, and increased erosion and sediment deposition) could result in long-term **minor** adverse risks to birds and could lead to changes in prey abundance and distribution, changes in nesting and foraging habitat abundance and distribution, and changes to migration patterns and timing. During construction, future offshore wind development activities may result in a small temporary increase in greenhouse gas (GHG) emissions (see Section 3.4.2.2.2). However, operation of these projects may beneficially contribute to a broader combination of actions to reduce future impacts to birds from climate change over the long term due to reduced reliance on fossil fuel–generated energy sources.

Light: Nighttime lighting associated with offshore structures and vessels could also represent a source of bird attraction. Under the No Action Alternative, offshore WTGs and OSSs would have hazard and aviation lighting that would be added beginning in 2021 and continuing through 2027 (see Table E1-3 in Appendix E1). Construction vessels are also a source of artificial lighting. Vessel lighting would be temporary and result in a **minor** adverse impact to birds; structure lighting may pose an increased collision or predation risk (Hüppop et al. 2006), although this risk would be localized in extent and minimized using BOEM lighting guidelines (BOEM 2021c; Kerlinger et al. 2010), and therefore would also be a **minor** adverse impact.

Noise: Table E-3 in Appendix E indicates that multiple offshore wind project construction periods are anticipated between 2022 and 2027. Construction noise sources will include, most notably, pile driving as well as geological and geophysical surveys, offshore and onshore construction, and aircraft and vessel traffic. These would create noise and may temporarily impact some bird species by displacing them and changing their behavior. Noise generated by construction equipment also has the potential to mask signals used by certain bird species for communication and mating, as well as hunting, which can lead to a decrease in bird density in the affected area (Bottalico et al. 2015). Potential impacts could be greater if avoidance and displacement of birds occur during seasonal migration periods. Noise transmitted through water could temporarily displace diving birds in a limited space around each pile and could cause short-term stress and behavioral changes ranging from mild annoyance to escape behavior (BOEM 2014b, 2016). Vessel and aircraft noise could also disturb some individual diving birds, but they would acclimate to the noise or move away, potentially resulting in temporary displacement. Collectively, these noise sources would be temporary and localized, resulting in a **minor** adverse impact to these birds.

Presence of structures: Onshore land development or port expansion activities could result in limited loss of nesting and/or foraging habitat for some bird species. The presence of offshore structures can lead to impacts, both beneficial and adverse, on birds through fish aggregation and the associated increase in foraging opportunities as well as entanglement and gear loss/damage, migration disturbances, and WTG strikes and displacement. These impacts may arise from buoys, met towers, foundations, scour/cable protections, and transmission cable infrastructure.

The primary threat to birds from the presence of structures would be from collision with WTGs. Birds are susceptible to collision with structures, particularly at night and/or during other periods of low visibility (e.g., rain or fog) (Stantec 2018). As discussed above, the Atlantic Flyway is an important migratory pathway for up to 164 species of waterbirds, and a similar number of land birds, with the greatest volume of birds using the Atlantic Flyway during annual migrations between wintering and breeding grounds (Watts 2010). As discussed in BOEM (2012), 55 bird species could encounter operating WTGs on the Atlantic OCS. However, the abundance of birds that overlap with the anticipated development of wind energy facilities on the Atlantic OCS is relatively small (Curtice et al. 2019; Winship et al. 2018). Of 55 bird species, 47 have sufficient survey data to calculate the modeled percentage of a species population that would overlap with the anticipated offshore wind development on the Atlantic OCS (Winship et al. 2018); the relative seasonal exposure is generally very low, ranging from 0.0% to 5.2% (Table 3.7-1). BOEM assumes that the 47 species (85%) with sufficient data to model the relative distribution and abundance are representative of the 55 species that may overlap offshore wind development on the Atlantic OCS.

Table 3.7-1. Percentage of Atlantic Seabird Populations that Overlap with Anticipated Offshore Wind Energy Development on the Outer Continental Shelf by Season

Species	Spring	Summer	Fall	Winter
Artic tern (*Sterna paradisaea*)	N/A	0.2%	N/A	N/A
Atlantic puffin (*Fratercula arctica*)	0.2%	0.1%	0.1%	0.2%
Audubon shearwater (*Puffinus lherminieri*)	0.0%	0.0%	0.0%	0.0%
Black-capped petrel (*Pterodroma hasitata*)	0.0%	0.0%	0.0%	0.0%
Black guillemot (*Cepphus grille*)	N/A	0.3%	N/A	N/A
Black-legged kittiwake (*Rissa tridactyla*)	0.7%	N/A	0.7%	0.5%
Black scoter (*Melanitta americana*)	0.2%	N/A	0.4%	0.5%
Bonaparte’s gull (*Chroicocephalus philadelphia*)	0.5%	N/A	0.4%	0.3%
Brown pelican (*Pelecanus occidentalis*)	0.1%	0.0%	0.0%	0.0%
Band-rumped storm-petrel (*Oceanodroma castro*)	N/A	0.0%	N/A	N/A
Bridled tern (*Onychoprion anaethetus*)	N/A	0.1%	0.1%	N/A
Common eider (*Somateria mollissima*)	0.3%	0.1%	0.5%	0.6%
Common loon (*Gavia immer*)	3.9%	1.0%	1.3%	2.1%
Common murre (*Uria aalge*)	0.4%	N/A	N/A	1.9%
Common tern (*Sterna hirundo*)	2.1%	3.0%	0.5%	N/A
Cory’s shearwater (*Calonectris borealis*)	0.1%	0.9%	0.3%	N/A
Double-crested cormorant (*Phalacrocorax auritus*)	0.7%	0.6%	0.5%	0.4%
Dovekie (*Alle alle*)	0.1%	0.1%	0.3%	0.2%
Great black-backed gull (*Larus marinus*)	1.3%	0.5%	0.7%	0.6%

Species	Spring	Summer	Fall	Winter
Great shearwater (*Puffinus gravis*)	0.1%	0.3%	0.3%	0.1%
Great skua (*Stercorarius skua*)	N/A	N/A	0.1%	N/A
Herring gull (*Larus argentatus*)	1.0%	1.3%	0.9%	0.5%
Horned grebe (*Podiceps auritus*)	N/A	N/A	N/A	0.3%
Laughing gull (*Leucophaeus atricilla*)	1.0%	3.6%	0.9%	0.1%
Leach's storm-petrel (*Oceanodroma leucorhoa*)	0.1%	0.0%	0.0%	N/A
Least tern (*Sternula antillarum*)	N/A	0.3%	0.0%	N/A
Long-tailed duck (*Clangula hyemalis*)	0.6%	0.0%	0.4%	0.5%
Manx shearwater (*Puffinus puffinus*)	0.0%	0.5%	0.1%	N/A
Northern fulmar (*Fulmarus glacialis*)	0.1%	0.2%	0.1%	0.2%
Northern gannet (*Morus bassanus*)	1.5%	0.4%	1.4%	1.4%
Parasitic jaeger (*Stercorarius parasiticus*)	0.4%	0.5%	0.4%	N/A
Pomarine jaeger (*Stercorarius pomarinus*)	0.1%	0.3%	0.2%	N/A
Razorbill (*Alca torda*)	5.2%	0.2%	0.4%	2.1%
Ring-billed gull (*Larus delawarensis*)	0.5%	0.5%	0.9%	0.5%
Red-breasted merganser (*Mergus serrator*)	0.5%	N/A	N/A	0.7%
Red phalarope (*Phalaropus fulicarius*)	0.4%	0.4%	0.2%	N/A
Red-necked phalarope (*Phalaropus lobatus*)	0.3%	0.3%	0.2%	N/A
Roseate tern (*Sterna* dougallii)	0.6%	0.0%	0.5%	N/A
Royal tern (*Thalasseus maximus*)	0.0%	0.2%	0.1%	N/A
Red-throated loon (*Gavia stellate*)	1.6%	N/A	0.5%	1.0%
Sooty shearwater (*Ardenna grisea*)	0.3%	0.4%	0.2%	N/A
Sooty tern (*Onychoprion fuscatus*)	0.0%	0.0%	N/A	N/A
South polar skua (*Stercorarius maccormicki*)	N/A	0.2%	0.1%	N/A
Surf scoter (*Melanitta perspicillata*)	1.2%	N/A	0.4%	0.5%
Thick-billed murre (*Uria lomvia*)	0.1%	N/A	N/A	0.1%
Wilson's storm-petrel (*Oceanites oceanicus*)	0.2%	0.9%	0.2%	N/A
White-winged scoter (*Melanitta deglandi*)	0.7%	N/A	0.2%	1.3%

Source: Calculated from Winship et al. (2018).

Notes: N/A = not applicable.

The primary operational impact to bird resources would be collision with turbines. In the contiguous United States, bird collisions with operating WTGs are believed to be a relatively rare event, with an estimated 140,000 to 328,000 (mean = 234,000) birds killed annually by 44,577 onshore turbines (Loss et al. 2013). Robinson Willmott et al. (2013) evaluated the sensitivity of bird resources to collision and/or displacement due to future wind development on the Atlantic OCS and included the 164 species selected by Watts (2010) plus an additional 13 species, for a total of 177 species that may occur on the Atlantic OCS from Maine to Florida during all or some portion of the year. As discussed in Robinson Willmott et al. (2013), species populations with high scores for sensitivity for collision include gulls, jaegers, and the northern gannet (*Morus bassanus*). In many cases, high collision sensitivity was driven by high occurrence on the Atlantic OCS, low avoidance rates with high uncertainty, and time spent in the RSZ. Many of the species addressed in Robinson Willmott et al. (2013) that had low collision sensitivity include migrating passerines that typically fly above the RSZ. As discussed in BOEM (2012), 55 species may be expected to have some level of potential overlap with the WEA and could encounter operating WTGs on the Atlantic OCS. However, generally the abundance of bird species that overlap with the anticipated development of wind energy facilities on the Atlantic OCS is relatively small. As described above, of the 177 species that may occur along the Atlantic coast, 55 are likely to encounter WTGs associated with offshore wind development. Of these, there are a total of 47 marine bird species with sufficient survey data to calculate the modeled percentage of a species population that would overlap with the anticipated offshore wind development on the Atlantic OCS (Winship et al. 2018); the relative seasonal exposure is generally very low, ranging from 0.0% to 5.2% (see Table 3.7-1). BOEM assumes that the 47 species (85%) with sufficient data to model the relative distribution and abundance on the Atlantic OCS are representative of the 55 species that may overlap with offshore wind development on the Atlantic OCS.

Additionally, with the proposed 1-nm (1.9-km) spacing between structures associated with future offshore wind development and the distribution of anticipated projects, only a small percentage of bird species migrating over the Atlantic OCS would encounter WTGs, with most flying above or below spinning turbines. Further, the spacing between turbines would likely permit birds to fly through individual lease areas without changing course or only making minor course corrections to avoid operating WTGs. Course corrections made to avoid a wind energy facility could result in exposure to one or more additional wind energy facilities within the GAA, but again, the 1-nm spacing would allow for migrating individuals to make only small course correction, if any, to avoid operating WTGs. Course corrections made by migratory birds to avoid a project or individual WTG would be relatively minor when compared to the distances traveled during seasonal long-distance migrations. Adverse impacts of additional energy expenditure due to minor course corrections or complete avoidance of lease areas would not be expected to be biologically significant, and no population-level effects would be expected. Therefore, these adverse impacts would be **minor**.

The addition of WTGs to the offshore environment could result in increased functional loss of habitat for those bird species with higher displacement sensitivity. However, substantial foraging habitat for resident birds would remain available. Further, a recent study of long-term data collected in the North Sea found that despite the extensive observed displacement of loons in response to the development of 20 wind farms, there was no decline in the region’s loon population (Vilela et al. 2021).

The presence of new structures could result in increased prey items for some marine bird species. WTG foundations could increase the mixing of surface waters and deepen the thermocline, possibly increasing pelagic productivity in local areas (English et al. 2017). The new structures may also create habitat for structure-oriented and/or hard-bottom species. This reef effect has been observed around WTGs, leading to local increases in biomass and diversity (Causon and Gill 2018). Invertebrate and fish assemblages may develop around these reef-like elements within the first year or two after construction (English et al. 2017). Although some studies have noted increased biomass and increased production of particulate organic matter by epifauna growing on submerged foundations, it is not clear to what extent the reef effect results in increased productivity versus simply attracting and aggregating fish from the surrounding areas (Causon and Gill 2018). Recent studies have found increased biomass for benthic fish and invertebrates, and possibly for pelagic fish, marine mammals, and birds as well (Pezy et al. 2018; Raoux et al. 2017; Wang et al. 2019), indicating that offshore wind energy facilities can generate beneficial permanent impacts on local ecosystems, translating to increased foraging opportunities for individuals of some marine bird species. BOEM anticipates that the presence of structures may result in permanent beneficial impacts. Conversely, increased foraging opportunities could attract marine birds, potentially exposing those individuals to increased collision risk associated with operating WTGs. Therefore, these impacts would be **minor** adverse.

3.7.1.2 Conclusions

Under the No Action Alternative, birds would continue to follow the current general trends and respond to current and future environmental and societal activities. Although the Project would not be built as proposed under the No Action Alternative, ongoing activities (e.g., commercial fisheries) and future offshore wind development would continue to have temporary to permanent adverse impacts (e.g., disturbance, displacement, injury, mortality, habitat degradation, habitat conversion) on birds primarily through accidental releases, anthropogenic noise, traffic, presence of structures, and climate change. In addition to ongoing activities, the impacts of planned actions other than offshore wind development, including new submarine cables and pipelines, increasing onshore construction, marine minerals extraction, port expansions, and the installation of new structures on the Atlantic OCS, would be **minor** adverse. The combination of ongoing activities and reasonably foreseeable activities other than offshore wind would result in **minor** adverse impacts on birds in the GAA.

Considering all the IPFs together, the overall impacts associated with offshore wind activities in the GAA would result in **minor** adverse impacts to birds. Most of the offshore structures in the GAA would be attributable to offshore wind development. Migratory birds that use the offshore WEAs during all or parts of the year would either be exposed to new collision risk or would have long-term functional habitat loss due to behavioral avoidance and displacement from WEAs on the Atlantic OCS. The offshore wind development would also be responsible for most of the impacts related to new cable emplacement and pile-driving noise, but impacts on birds resulting from these IPFs would be localized and temporary and would not be biologically significant.

The No Action Alternative would forgo postconstruction avian monitoring for migratory birds and ESA-listed species and annual mortality reporting, the results of which could contribute to an improved understanding of the effects of offshore wind development, benefit the future management of these species, and inform planning of other offshore development. However, ongoing and future surveys and monitoring could still supply similar data.

3.7.2 Environmental Consequences

3.7.2.1 Relevant Design Parameters, Impact-Producing Factors, and Potential Variances in Impacts

This assessment analyzes the maximum-case scenario; however, there is the potential for variances in the proposed Project build-out, as defined in the PDE (see Appendix D). The Project design parameters that would influence the magnitude of the impacts on bats include the number, size, and location of WTGs; the location of the OnSS and ICF; the type of lighting to be used; the location of construction within the landfall work area and within the transmission cable envelope; and the time of year during which construction occurs. Impacts associated with construction of onshore elements of the Proposed Action during the breeding season for birds could be avoided if onshore construction occurs outside of this time frame.

The following EPMs would be implemented to minimize potential impacts to birds:

- Revolution Wind evaluated siting alternatives for the OnSS using the criteria that included avoidance or minimization of disturbance to ecologically sensitive areas.
- The OnSS and ICF would be located on parcels that are already highly altered and include buried demolition waste.
- The transmission cable would be located primarily in unvegetated and previously disturbed or developed ROWs.

These EPMs would be implemented across all alternatives; therefore, BOEM would not expect measurable potential variances in impacts across the alternatives.

See Appendix E1 for a summary of IPFs analyzed for birds across all action alternatives. IPFs that are either not applicable to the resource or determined by BOEM to have a negligible adverse effect are excluded from Chapter 3 and provided in Table E1-3 in Appendix E1. Offshore and onshore IPFs are addressed separately in the analysis if appropriate for the resource; not all IPFs have both an offshore and onshore component. Where feasible, calculations for specific alternative impacts are provided in Appendix E4, to facilitate reader comparison across alternatives.

Table 3.7-2 provides a summary of IPF findings carried forward for analysis in this section. Each alternative analysis discussion consists of the construction and installation phase, the O&M phase, the decommissioning phase, and the cumulative analysis. If these analyses are not substantially different, then they are presented as one discussion.

A detailed analysis of the Proposed Action is provided following the table. Detailed analysis of other considered action alternatives is also provided below the table if analysis indicates that the alternative(s) would result in substantially different impacts than the Proposed Action.

The Conclusion section within each alternative analysis discussion includes rationale for the effects determinations.

The overall impact to birds from any action alternative would be **minor** adverse, as the effects would be small, and the resource would recover completely, with no mitigating action required.

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Table 3.7-2. Alternative Comparison Summary for Birds

Impact-Producing Factor	No Action Alternative	Alternative B (Proposed Action) up to 100 WTG	Alternative C (Habitat Alternative) 64–65 WTGs	Alternative D (Transit Alternative) 78–93 WTGs	Alternative E (Viewshed Alternative) 64–81 WTGs	Alternative F (Higher Capacity Turbine Alternative) 56 WTGs
Accidental releases and discharges	Future offshore wind and non-wind activities could expose coastal offshore waters to contaminants (e.g., fuel, sewage, solid waste, or chemicals, solvents, oils, or grease from equipment) in the event of a spill or release during routine vessel use. Vessel compliance with USCG regulations would minimize trash or other debris; therefore, BOEM expects accidental trash releases from offshore wind vessels to be rare. All future offshore wind projects would be required to comply with regulatory requirements related to the prevention and control of accidental spills administered by the USCG and BSEE. OSRPs are required for each project and would provide for rapid spill response, cleanup, and other measures that would help to minimize potential impacts on affected resources from spills. Based on the low risk of spills from vessels due to implementation of safe handling, storage, and cleanup procedures, impacts from accidental spills and trash would represent a **negligible** adverse impact to birds.	**Offshore**: Potential adverse impacts to birds from contaminant discharges or releases or from improper disposal of trash or debris during construction would be avoided or minimized with adherence to federal, state, and local regulations regarding disposal of solid and liquid wastes, resulting in short-term **negligible** to **minor** adverse impacts. Accidental releases, if any, would occur infrequently at discrete locations and vary widely in space and time; for this reason, BOEM expects localized and temporary **negligible** adverse impacts on birds. Impacts to birds from this IPF during operation and decommissioning of the offshore facilities would be similar to offshore construction impacts and result in short-term **negligible** to **minor** adverse impacts with compliance with USCG requirements and BSEE regulations. In the context of reasonably foreseeable environmental trends, the combined impacts from this IPF from ongoing and planned actions, including the Proposed Action, would be likely limited in extent and duration and would result in localized and temporary **negligible** adverse cumulative impacts on birds.	**Offshore**: Alternatives C through F would reduce the number of WTGs, potentially resulting in a reduced amount of offshore construction equipment and vessels required, thereby resulting in a negligible decreased risk for accidental releases and discharges. However, no measurable change from Proposed Action construction impacts to birds from this IPF is anticipated, which are expected to be localized and temporary **negligible** to **minor** adverse. Impacts to birds from this IPF during operation and decommissioning of the offshore facilities are expected to be similar to offshore construction impacts, and no measurable change from Proposed Action construction impacts to birds from this IPF is anticipated, which are expected to be **negligible** to **minor** adverse. Future offshore wind activities would contribute to an increased risk of spills and associated impacts due to fuel, fluid, or hazmat exposure. The contribution from future offshore wind and Alternatives C through F would be a low and non-measurable percentage of the overall spill risk from ongoing activities. In the context of reasonably foreseeable environmental trends, the combined impacts from this IPF from ongoing and planned actions, including Alternatives C through F, would be likely limited in extent and duration of a release and result in localized and temporary **negligible** adverse cumulative impacts to birds.			
		Onshore: Onshore, construction and HDD activities could result in the accidental releases of fuel, fluids, or hazmat; sediment; and/or trash and debris. Based on the low risk of spills due to implementation of safe handling, storage, and cleanup procedures, impacts from accidental spills and trash would represent a localized and temporary **negligible** adverse impact to birds. The OnSS would require various oils, fuels, and lubricants to support its operation. Accidental discharges, releases, and disposal could indirectly cause bird habitat degradation; however, risks would be avoided through spill prevention and control measures and associated BMPs. Therefore, potential adverse impacts associated with discharges and releases are considered short term and localized **negligible** adverse. In the context of reasonably foreseeable environmental trends, the combined impacts from this IPF from ongoing and planned actions, including the Proposed Action, would be localized and temporary due to the likely limited extent and duration of a release and result in **negligible** adverse cumulative impacts to birds.	**Onshore**: Alternatives C through F would not alter impacts to onshore activities; therefore, impacts would be the same as those described for the Proposed Action: temporary to short term **negligible** adverse.			

Impact-Producing Factor	No Action Alternative	Alternative B (Proposed Action) up to 100 WTG	Alternative C (Habitat Alternative) 64–65 WTGs	Alternative D (Transit Alternative) 78–93 WTGs	Alternative E (Viewshed Alternative) 64–81 WTGs	Alternative F (Higher Capacity Turbine Alternative) 56 WTGs
Anchoring and new cable emplacement/ maintenance	A small amount of infrequent construction impacts associated with onshore power infrastructure would be required over the next 6 to 10 years to tie future offshore wind energy projects to the electric grid. Typically, this would require only small amounts of habitat removal, if any, and would occur primarily in previously disturbed areas. Where future offshore wind activities overlap the GAA, there would be increased anchoring of vessels during survey activities and during the construction and installation, O&M, and decommissioning of offshore components. Disturbed seafloor from construction of future offshore wind projects and anchoring may affect diving birds' foraging success or may affect some prey species (e.g., benthic assemblages); however, impacts would be temporary and localized, and birds would be able to successfully forage in adjacent areas and would not be affected by increased suspended sediments and no population-level impacts would occur. Therefore, adverse impacts would be **minor**.	**Offshore**: Seafloor disturbed by cable installation and dredging prior to cable installation would result in turbidity effects that could reduce marine bird foraging success or have temporary and localized impacts on marine bird prey species. Vessel anchoring during construction would also result in increased turbidity. Individual birds would successfully forage in nearby areas not affected by increased turbidity/sedimentation during anchoring and cable emplacement, and only nonmeasurable **negligible** adverse impacts, if any, on individuals or populations would be expected given the localized and temporary nature of construction activities. Other than temporary increases in turbidity from seafloor disturbance due to occasional vessel anchoring, no impacts to bird species are anticipated during the O&M phase for the offshore RWF or RWEC. Impacts from decommissioning would be similar to construction impacts unless the RWEC is abandoned in place: **negligible** adverse. In the context of reasonably foreseeable environmental trends, the combined cable emplacement impacts from ongoing and planned actions, including the Proposed Action, could occur if impacts are in close temporal and spatial proximity. However, these adverse impacts from anchoring and cable emplacement would be **negligible** and would not be biologically significant. For these reasons, the Proposed Action when combined with other past, present, and reasonably foreseeable projects would result in short-term **negligible** to **minor** cumulative adverse impacts to birds.	**Offshore**: Alternatives C through F would reduce the number of WTG foundations and IACs. Reduced habitat disturbance from foundation and IAC installation could negligibly decrease turbidity that could alter the behavior of bird species. Therefore, BOEM would expect a similar but lower impact to birds than the Proposed Action: temporary, lasting up to 12 hours, localized and nonmeasurable **negligible** adverse impacts. Similar to the Proposed Action, no impacts to bird species are anticipated during the O&M phase for the offshore RWF or RWEC. Impacts from decommissioning would be similar to construction impacts unless the RWEC is abandoned in place: **negligible** adverse. Alternatives C through F would add 5,864 to 6,665 acres of seafloor disturbance from operation of WTG foundations and scour protection, the RWEC and IAC installation, and anchoring to the No Action Alternative, which represents up to 28% of the total seafloor disturbance estimated under the No Action Alternative. This would result in localized turbidity effects that could reduce marine bird foraging success or impact marine bird prey species. However, individual birds would be expected to successfully forage in nearby areas not affected by increased turbidity, and only nonmeasurable negligible impacts, if any, on individuals or populations would be expected given the localized and temporary nature of the potential impacts. In the context of reasonably foreseeable environmental trends, the combined cable emplacement and anchoring impacts from ongoing and planned actions, including Alternatives C through F, could occur if impacts are in close temporal and spatial proximity. However, these adverse impacts from anchoring and cable emplacement would be negligible and would not be biologically significant. For these reasons, these alternatives in combination with other past, present, and reasonably foreseeable projects would result in short-term **negligible** to **minor** adverse cumulative impacts to birds.			
		Onshore: Land disturbance and habitat alteration resulting from construction within the landfall work area may result in the direct injury or mortality of bird species. Mitigations like observing time-of-year restrictions on vegetation removal would avoid the breeding season of birds, thus reducing the likelihood of injury and/or mortality from construction activities. Therefore, the impacts (e.g., injury and/or mortality) resulting from land disturbance and habitat alteration would be temporary **negligible** adverse. Additionally, construction work within the landfall work area would occur largely outside of the breeding period of listed species that might nest in the area, and because use of the shoreline by shorebirds within the landfall work area has not been documented (vhb 2021), onshore impacts for listed species from land disturbance would also be **negligible** adverse. Onshore transmission cable installation would also result in temporary ground disturbance. Most of the temporary ground disturbance would occur in previously disturbed areas along paved roads or parking lots and would not result in impacts to bird habitat. Operation of the onshore transmission cable would pose no risk to birds because it would be buried. Land disturbance in the form of vegetation management would occur on a periodic basis to maintain vegetation at shrub height within the perimeters of the onshore facilities. Land disturbance as it relates to vegetation clearing may	**Onshore**: Alternatives C through F would not alter impacts to onshore activities; therefore, impacts would be the same as those described for the Proposed Action: **negligible** adverse.			

Impact-Producing Factor	**No Action Alternative**	**Alternative B (Proposed Action) up to 100 WTG**	**Alternative C (Habitat Alternative) 64–65 WTGs**	**Alternative D (Transit Alternative) 78–93 WTGs**	**Alternative E (Viewshed Alternative) 64–81 WTGs**	**Alternative F (Higher Capacity Turbine Alternative) 56 WTGs**
		result in the direct injury or mortality of birds. However, mortality and injury impacts would be mitigated by observing time-of-year restrictions on vegetation removal that would avoid the breeding season of bird species. Therefore, the adverse impacts resulting from this IPF would be **negligible**. The contribution of the Proposed Action on adverse cumulative impacts to birds from new cable emplacement or maintenance in the context of reasonably foreseeable onshore environmental trends within the GAA is expected to be **negligible** adverse.				
Climate change	Impacts associated with climate change (i.e., increased storm severity and frequency, ocean acidification, altered migration patterns, increased disease frequency, habitat conversion, and increased erosion and sediment deposition) could result in long-term **minor** adverse risks to birds and could lead to changes in prey abundance and distribution, changes in nesting and foraging habitat abundance and distribution, and changes to migration patterns and timing. However, future offshore wind development activities may beneficially contribute to a broader combination of actions to reduce future impacts to birds from climate change over the long term due to reduced reliance on fossil fuel–generated energy sources.	**Offshore**: Construction of the offshore facilities would result in a small temporary increase in GHG emissions within the GAA during the construction phase. As a result, adverse impacts to birds from construction of the Proposed Action associated with climate change would be short term **negligible** adverse. The expected impacts on climate change from operation of the offshore facilities alone would not result in a measurable increase in the adverse impacts to birds beyond those described under the No Action Alternative. In addition, operation of the Proposed Action could also contribute to a long-term net decrease in GHG emissions, but this change would likely not be measurable. Therefore, BOEM expects the impacts from the Proposed Action on climate change would be long term **negligible**. The types of impacts from global climate change described for the No Action Alternative would occur under the Proposed Action. Therefore, long-term **minor** adverse and long-term **negligible** beneficial cumulative impacts to birds are expected.	**Offshore**: Alternatives C through F would reduce the number of WTGs, potentially resulting in a reduced number of GHG-emitting construction vessels and/or aircraft. However, no measurable change from Proposed Action construction impacts to birds from this IPF is anticipated, which are expected to be short term **negligible** adverse. Likewise, no measurable change from Proposed Action operational impacts to birds is anticipated, which are expected to be long term **negligible** adverse. The types of impacts from global climate change described for the No Action Alternative would occur under Alternatives C through F. However, Alternatives C through F could also contribute to a long-term net decrease in GHG emissions. This difference may not be measurable but would help reduce climate change impacts. Therefore, long-term **minor** adverse and long-term **negligible** beneficial cumulative impacts to birds are expected.			
		Onshore: Onshore impacts to birds associated with climate change from construction and decommissioning of the Proposed Action would be similar to those discussed above for offshore facilities and activities: short term **negligible** adverse. No measurable climate change impacts to birds from O&M of the onshore facilities are expected. Therefore, the adverse impacts from this IPF are expected to be long term **negligible** adverse. The types of impacts from global climate change described for the No Action Alternative would occur under the Proposed Action. Therefore, the combined impacts from this IPF from ongoing and planned actions, including the Proposed Action and cumulative impacts, are expected to be long term **minor** adverse.	**Onshore**: The Habitat Alternative would not alter impacts to onshore activities; therefore, construction and operational impacts would be the same as those described for the Proposed Action: short term to long-term **negligible** adverse. Cumulative impacts would also be the same as those described for the Proposed Action: long term **minor** adverse.			

<table>
<tr><th>Impact-Producing Factor</th><th>No Action Alternative</th><th>Alternative B (Proposed Action)
up to 100 WTG</th><th>Alternative C
(Habitat Alternative)
64–65 WTGs</th><th>Alternative D
(Transit Alternative)
78–93 WTGs</th><th>Alternative E
(Viewshed Alternative)
64–81 WTGs</th><th>Alternative F
(Higher Capacity Turbine Alternative)
56 WTGs</th></tr>
<tr><td rowspan="2">Light</td><td rowspan="2">Nighttime lighting associated with offshore structures and vessels could represent a source of bird attraction. Vessel lighting would be temporary and result in a minor adverse impact to birds; structure lighting may pose an increased collision or predation risk (Hüppop et al. 2006), although this risk would be localized in extent and minimized using BOEM lighting guidelines (BOEM 2021c; Kerlinger et al. 2010), and therefore would also be a minor adverse impact.</td><td>Offshore: Lighting used during construction would be limited to the minimum required for safety during construction activities to minimize potential impacts. Therefore, adverse impacts to birds from lighting during construction would be localized and temporary negligible to minor adverse.
Under the Proposed Action, up to 100 WTGs and up to two OSSs would be lit with USCG navigational and FAA hazard lighting. These lights have some potential to attract birds and result in increased collision risk (Hüppop et al. 2006). However, the mandatory use of red flashing aviation obstruction lights and the avoidance of any steady-burning aviation obstruction lights are expected to minimize bird attraction and therefore collision risk (Kerlinger et al. 2010; Orr et al. 2016). For this reason, BOEM expects adverse impacts, if any, to be long term negligible adverse from offshore lighting.
Ongoing and future non–offshore wind activities are expected to cause short-term impacts, primarily from vessel lights. For these reasons, the Proposed Action when combined with past, present, and reasonably foreseeable activities would result in long-term negligible to minor adverse cumulative impacts to birds, and no individual or population-level impacts would be expected.</td><td colspan="4">Offshore: Although the number and duration of construction vessels and work areas requiring nighttime lighting could be slightly reduced under Alternatives C through F, no measurable change from Proposed Action construction impacts to birds is anticipated, which are expected to be localized and temporary negligible to minor adverse.
Alternatives C through F would reduce nighttime lighting, thereby negligibly decreasing the risk of avian injury or mortality from collision with WTGs as compared to the Proposed Action, and impacts are expected to be long term negligible adverse.
Alternatives C through F would add 56 to 93 new WTGs with red flashing aviation hazard lighting to the No Action Alternative; these lights could attract birds and result in increased collision risk (Hüppop et al. 2006). Additionally, marine navigation lighting would include one or more flashing white lights on each WTG and the OSSs and would be directed out and down to the water surface. Vessel lights during construction and installation, O&M, and decommissioning would be minimal and limited to vessels transiting to and from wind farm areas. Ongoing and future non–offshore wind activities are expected to cause short-term impacts, primarily from vessel lights. For these reasons, Alternatives C through F when combined with past, present, and reasonably foreseeable activities would result in long-term negligible to minor cumulative adverse impacts to birds because no individual or population-level impacts would be expected.</td></tr>
<tr><td>Onshore: Most of the onshore construction would occur during the daylight hours, although some overnight lighting may occasionally be necessary during construction of the onshore facilities. However, this is not expected to have a measurable effect on bird behavior, therefore BOEM anticipates temporary negligible adverse impacts to birds.
During the O&M of the OnSS and ICF, yard lighting would be used for assessment of equipment. Most decommissioning activities would occur during the day, and overnight lighting would only be necessary if there is work in progress on-site or lights are left on for safety and security purposes. Therefore, the adverse impacts resulting from this IPF would be long term negligible.
Ongoing and future onshore activities could contribute to impacts to birds from light if they occur at the same time within the GAA. However, these effects are also expected to be localized and temporary and would not contribute to adverse cumulative impacts to birds in the GAA.</td><td colspan="4">Onshore: Alternatives C through F would not alter impacts to onshore activities; therefore, construction and operational impacts would be the same as those described for the Proposed Action: temporary to long-term negligible adverse.
Cumulative impacts would also be the same as those described for the Proposed Action: localized and temporary negligible to minor adverse.</td></tr>
</table>

Impact-Producing Factor	**No Action Alternative**	**Alternative B (Proposed Action) up to 100 WTG**	**Alternative C (Habitat Alternative) 64–65 WTGs**	**Alternative D (Transit Alternative) 78–93 WTGs**	**Alternative E (Viewshed Alternative) 64–81 WTGs**	**Alternative F (Higher Capacity Turbine Alternative) 56 WTGs**
Noise	Multiple offshore wind project construction periods are anticipated between 2022 and 2027. Construction noise sources will include, most notably, pile driving as well as geological and geophysical surveys, offshore and onshore construction, and aircraft and vessel traffic. These would create noise and may temporarily impact some bird species by displacing them and changing their behavior. Vessel and aircraft noise could also disturb some individual diving birds, but they would acclimate to the noise or move away, potentially resulting in temporary displacement. Collectively, these noise sources would be temporary and localized, resulting in a **minor** adverse impact to these birds.	**Offshore**: **Negligible** to **minor** adverse impacts to birds would occur from construction noise related to pile driving as well as geological and geophysical surveys and aircraft and vessel traffic. These activities could flush birds in the path of vessels, causing temporary displacement from the area. Impacts to birds from operational noise and decommissioning of the offshore facilities would be similar to offshore construction impacts and result in **negligible** adverse impacts. Pile driving and other construction noise and activity associated with the Proposed Action could add to baseline noise and activity associated with other offshore wind projects with overlapping construction periods. Therefore, the Proposed Action when combined with past, present, and reasonably foreseeable activities would result in **negligible** to **minor** adverse cumulative impacts to birds.	**Offshore**: Alternatives C through F would slightly decrease noise associated with pile driving for WTGs and other construction-related noise as compared to the Proposed Action, which are short-term **negligible** to **minor** adverse impacts. No measurable change from Proposed Action O&M impacts is anticipated because operational noise sources and levels would be the same: long-term **negligible** adverse impacts. Pile driving and other construction noise and activity associated with Alternatives C through F could add to baseline noise and activity associated with other offshore wind projects with overlapping construction periods. Potential impacts could be greater if avoidance and displacement of birds occur during seasonal migration periods. However, Alternatives C through F's contribution would be limited in duration, negligible, and cease when construction ends. No individual fitness (i.e., a bird's ability to survive and reproduce) or population-level effects would be expected. Therefore, these alternatives when combined with past, present, and reasonably foreseeable activities would result in **negligible** to **minor** cumulative adverse impacts to birds.			
		Onshore: Noise from traffic associated with construction and vegetation removal within the landfall work area and other onshore facilities could affect shorebirds, some seabirds, and land birds that use the terrestrial habitats in the immediate vicinity of construction activities through displacement or avoidance behavior of individuals and/or disruptions in communication, mating, and hunting. The impacts associated with construction would be similar to existing sources of noise and traffic in the local area and therefore are considered a temporary **negligible** adverse impact. Temporary noise and construction-related traffic may occasionally be generated due to nonroutine maintenance. Infrequent vehicle usage within the OnSS and ICF may create temporary noise-related disturbance to birds adjacent to the OnSS. However, such disturbance would be short term, and normal avian activity would likely resume after the traffic ceases. BOEM expects these adverse impacts to be **negligible**. In the context of reasonably foreseeable environmental trends, the combined impacts from this IPF from ongoing and planned actions, including the Proposed Action, would be localized and temporary due to the likely limited extent and duration of noise and would result in **negligible** adverse cumulative impacts to birds.	**Onshore**: Alternatives C through F would not alter impacts to onshore activities; therefore, impacts would be the same as those described for the Proposed Action: temporary **negligible** adverse.			

Impact-Producing Factor	**No Action Alternative**	**Alternative B (Proposed Action) up to 100 WTG**	**Alternative C (Habitat Alternative) 64–65 WTGs**	**Alternative D (Transit Alternative) 78–93 WTGs**	**Alternative E (Viewshed Alternative) 64–81 WTGs**	**Alternative F (Higher Capacity Turbine Alternative) 56 WTGs**
Presence of structures	Onshore land development or port expansion activities could result in limited loss of nesting and/or foraging habitat for some bird species. The presence of offshore structures can lead to impacts, both beneficial and adverse, on birds through fish aggregation and the associated increase in foraging opportunities as well as entanglement and gear loss/damage, migration disturbances, and WTG strikes and displacement. These impacts may arise from buoys, met towers, foundations, scour/cable protections, and transmission cable infrastructure. Therefore, these impacts would be **minor** adverse.	**Offshore**: The various types of impacts on birds that could result from the presence of structures during construction include fish aggregation and an associated increase in foraging opportunities as well as entanglement and fishing gear loss/damage, migration disturbances, and displacement. These impacts would be temporary, and BOEM expects them to be **negligible** adverse. **Negligible** to **minor** temporary adverse impacts from bird collisions with visible structures could occur during construction, depending on the species and number of individuals involved. The presence and operation of the offshore facilities may result in displacement of waterbirds, waterfowl, seabirds, and phalaropes that use the area for foraging, resting, or nighttime roosting. Long-term adverse impacts would be **negligible** to **minor**, depending on whether birds are at high risk for displacement or are able to access preferred habitat, and these impacts may change over time if birds become habituated to the presence of the WTGs and OSSs. Impacts to birds from decommissioning of the RWF and offshore RWEC would be similar to those described for the construction phase. The Project is not expected to affect special-status species populations. Cumulative impacts on birds from the presence of structures associated with the Proposed Action when combined with past, present, and reasonably foreseeable activities would be long term **minor** adverse and long term **minor** beneficial.	**Offshore**: Alternatives C through F would reduce the number of WTGs, potentially resulting in a reduced amount of offshore construction equipment and vessels required. However, because bird exposure to vessels and installation infrastructure would be temporally limited to the construction period, the behavioral vulnerability to collision with construction equipment under Alternatives C through F is expected to be the same as described for the Proposed Action, which are **negligible** to **minor** temporary adverse impacts. During operations, Alternatives C through F would reduce the number of WTGs, potentially allowing for improved maneuverability for birds through the Lease Area and negligibly decreasing the risk of injury or mortality from collision with WTGs as compared to the Proposed Action, and impacts are expected to be long term **negligible** to **minor** adverse. Alternatives C through F would add 56 to 93 additional WTGs and up to two OSSs compared to the No Action Alternative. The total cumulative foundations on the Atlantic OCS would be 3,110, and the Project would account for less than 4% of that total number. Adverse impacts to migration patterns or collision risk from these additional turbines would be negligible and persist until decommissioning is complete. Additionally, beneficial impacts to foraging near offshore structures would similarly be negligible and persist for the life of the Project. Therefore, cumulative impacts on birds from the presence of structures associated with these alternatives when combined with past, present, and reasonably foreseeable activities would be long term **minor** adverse and long term **minor** beneficial.			
		Onshore: Impacts from habitat alteration and land disturbance on coastal and terrestrial bird habitats generated from the construction of the onshore facilities would create habitat loss and conversion, affect bird habitat use, and possibly create habitat degradation. During the breeding season, clearing of trees or vegetation could result in destruction of nests, adversely impacting some individuals. However, lasting impacts to local breeding populations are not anticipated. Collisions between birds and vehicles or construction equipment have some limited potential to cause injury and mortality. Therefore, impacts to birds from construction of onshore facilities would be short term **negligible** to **minor** adverse. The OnSS and ICF would be visible structures that would result in permanent bird habitat conversion and loss. The OnSS access road and fenced-in property would become nonhabitat and result in habitat fragmentation. The conversion of forested cover type outside the OnSS and ICF fences would alter the structural diversity within a forested area by adding more edge habitat. Considering the adjacent landscape consists primarily of residential and commercial developments with some undisturbed areas of ruderal forested swamp, the adverse impacts to birds from the OnSS and the ICF on forested habitat fragmentation would be long term **negligible** to **minor**. The potential for avian mortality or injury due to the low risk of collision with the OnSS and related structures would be a long-term	**Onshore**: Alternatives C through F would not alter impacts to onshore activities; therefore, impacts would be the same as those described for the Proposed Action: temporary to long-term **negligible** to **minor** adverse.			

Impact-Producing Factor	No Action Alternative	Alternative B (Proposed Action) up to 100 WTG	Alternative C (Habitat Alternative) 64–65 WTGs	Alternative D (Transit Alternative) 78–93 WTGs	Alternative E (Viewshed Alternative) 64–81 WTGs	Alternative F (Higher Capacity Turbine Alternative) 56 WTGs
		minor adverse impact. The potential for avian avoidance behavior related to habitat conversion and loss from the OnSS would also be a long-term **minor** adverse impact. Adverse impacts to birds from habitat fragmentation related to a visible change in the landscape during decommissioning would be **negligible** because local populations would have adapted to the landscape changes. The presence of these structures when considered in the context of ongoing and planned actions within the GAA would be a very minor risk of mortality or injury to birds due to collision, and generally, the changes to the habitat conditions would result in avoidance behavior and may influence bird habitat selection. Therefore, BOEM anticipates long-term **negligible** to **minor** adverse cumulative impacts to birds.				

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3.7.2.2 Alternative B: Impacts of the Proposed Action Alternative on Birds

3.7.2.2.1 Construction and Installation

Offshore Activities and Facilities

Accidental releases and discharges: Some potential for mortality, decreased fitness, and health effects exists due to the accidental release of fuel, hazmat, and trash and debris from vessels associated with construction and installation of the Proposed Action. Vessels associated with the Proposed Action may generate operational waste, including bilge and ballast water, sanitary and domestic wastes, and trash and debris. All vessels associated with the Proposed Action would comply with USCG requirements and BSEE regulations for the prevention and control of oil and fuel spills. Potential adverse impacts to birds from contaminant discharges or releases or from improper disposal of trash or debris during construction would be avoided or minimized with adherence to federal, state, and local regulations regarding disposal of solid and liquid wastes, resulting in short-term **negligible** to **minor** adverse impacts. Accidental spills or releases of oils or other hazardous materials offshore would be managed through the OSRP (see COP Appendix D). Additionally, training and awareness of BMPs proposed for waste management and mitigation of marine debris would be required of Project personnel, reducing the likelihood of occurrence to a very low risk. These accidental releases, if any, would occur infrequently at discrete locations and vary widely in space and time; for this reason, BOEM expects localized and temporary **negligible** adverse impacts on birds.

Anchoring and new cable emplacement/maintenance: Construction of the WTG foundations and the installation of the submarine cables could result in short-term habitat disturbance for foraging birds. Seafloor disturbed by cable installation and dredging prior to cable installation would result in turbidity effects that could reduce marine bird foraging success or have temporary and localized impacts on marine bird prey species. These impacts would be temporary, lasting up to 12 hours, and localized to the emplacement corridor. Vessel anchoring during construction would also result in increased turbidity. Individual birds would successfully forage in nearby areas not affected by increased turbidity/sedimentation during anchoring and cable emplacement, and only nonmeasurable **negligible** adverse impacts, if any, on individuals or populations would be expected given the localized and temporary nature of construction activities.

Climate change: Construction of the offshore facilities would result in a small temporary increase in GHG emissions within the GAA during the construction phase. However, these emissions could be reduced by staggering construction time frames and implementing applicant-proposed EPMs (see Table G-1 in Appendix G). As a result, adverse impacts to birds from construction of the Proposed Action associated with climate change would be short term **negligible** adverse.

Light: Lighting used during construction would be limited to the minimum required for safety during construction activities to minimize potential impacts. Therefore, adverse impacts to birds from lighting during construction would be localized and temporary **negligible** to **minor** adverse.

Noise: **Negligible** to **minor** adverse impacts to birds would occur from construction noise related to pile driving as well as geological and geophysical surveys and aircraft and vessel traffic. These activities could flush birds in the path of vessels, causing temporary displacement from the area. However, these impacts would be temporary and similar to baseline conditions as vessel traffic already occurs, resulting in similar temporary displacement of birds in the GAA (Stantec 2018). These impacts could be greater if avoidance and displacement of birds occur during seasonal migration periods.

Presence of structures: The various types of impacts on birds that could result from the presence of structures during construction include fish aggregation and an associated increase in foraging opportunities as well as entanglement and fishing gear loss/damage, migration disturbances, and displacement. These impacts would be temporary, and BOEM expects them to be **negligible** adverse. **Negligible** to **minor** temporary adverse impacts from bird collisions with visible structures could occur during construction, depending on the species and number of individuals involved.

Onshore Activities and Facilities

Accidental releases and discharges: Onshore, construction and HDD activities could result in the accidental releases of fuel, fluids, or hazmat; sediment; and/or trash and debris. These releases, if any, would occur infrequently at discrete locations and vary widely in space and time. Revolution Wind would prepare a construction SPCC plan in accordance with applicable requirements and would outline spill prevention training, plans, and steps to take to contain and clean up spills that could occur. Based on the low risk of spills due to implementation of safe handling, storage, and cleanup procedures, impacts from accidental spills and trash would represent a localized and temporary **negligible** adverse impact to birds.

Climate change: Onshore impacts to birds associated with climate change from construction of the Proposed Action would be similar to those discussed above for offshore facilities and activities: short term **negligible** adverse.

Light: Most of the onshore construction would occur during the daylight hours, although some overnight lighting may occasionally be necessary during construction of the onshore facilities. However, this is not expected to have a measurable effect on bird behavior, therefore BOEM anticipates temporary **negligible** adverse impacts to birds.

New cable emplacement/maintenance: Land disturbance and habitat alteration resulting from construction within the landfall work area may result in the direct injury or mortality of bird species. Mobile individuals would be able to temporarily vacate an area of disturbance and therefore would be less susceptible to mortality or injury compared to less mobile (pre-volant) individuals. Mitigations like observing time-of-year restrictions on vegetation removal would avoid the breeding season of birds, thus reducing the likelihood of injury and/or mortality from construction activities. Therefore, the impacts (e.g., injury and/or mortality) resulting from land disturbance and habitat alteration would be temporary **negligible** adverse. Further, HDD would be employed to make the connection between the onshore transmission cable and the landfall work area, which would limit or completely avoid impacts to the human-made shoreline and the ruderal grassland/shrubland because the onshore transmission cable would be installed under these resources. Because construction work within the landfall work area would occur largely outside of the breeding period of listed species that might nest in the area, and because use of the shoreline by shorebirds within the landfall work area has not been documented (vhb 2021), onshore impacts for listed species from land disturbance would be **negligible** adverse. A detailed impacts analysis to federally listed birds from construction activities is in the USFWS BA (BOEM 2022).

The temporary onshore construction work area for HDD operations would likely be situated within a previously developed area (e.g., an existing parking lot) and would not impact the human-made shoreline and/or the ruderal grassland/shrubland. Because the landfall work area is limited to anthropogenically made or disturbed features of the human-made shoreline and the ruderal grassland/shrubland, the potential for land disturbance and habitat alteration to significantly affect birds is **negligible** adverse. Additional land disturbance and habitat alteration would result from the installation of the onshore transmission cable from the transition joint bays to the OnSS. The onshore transmission cable installation would result in temporary ground disturbance. Most of the temporary ground disturbance would occur in previously disturbed areas along paved roads or parking lots and would not result in impacts to bird habitat.

Onshore transmission cable installation would also result in temporary ground disturbance. Most of the temporary ground disturbance would occur in previously disturbed areas along paved roads or parking lots and would not result in impacts to bird habitat.

<u>Noise:</u> Noise from traffic associated with construction and vegetation removal within the landfall work area and other onshore facilities could affect shorebirds, some seabirds, and land birds that use the terrestrial habitats in the immediate vicinity of construction activities through displacement or avoidance behavior of individuals and/or disruptions in communication, mating, and hunting. Displacement and avoidance behavior are expected to only occur during construction, which would occur primarily in already developed areas where birds are habituated to these types of activities. The impacts associated with construction would be similar to existing sources of noise and traffic in the local area and therefore are considered a temporary **negligible** adverse impact.

<u>Presence of structures:</u> Impacts from habitat alteration and land disturbance on coastal and terrestrial bird habitats generated from the construction of the onshore facilities would create habitat loss and conversion, affect bird habitat use, and possibly create habitat degradation. The OnSS and ICF parcels include ruderal forested swamp, shrub marsh, ruderal mixed oak/white pine forest, ruderal pitch pine barren, and a landfill. Vegetation clearing and ongoing vegetation management would convert some of these cover types to permanently developed land or shrubland within the areas that would undergo vegetation maintenance. This habitat conversion may be detrimental to species reliant on forest habitat but beneficial to other species that are more suited to the newly converted habitat (e.g., passerines adapted to grassland and shrubland). The OnSS would result in a permanent loss of 3.8 acres of mixed oak/white pine forest and 0.6 acre of ruderal pitch pine barren. However, the portion of forested habitat removal would be small relative to the available forested habitat in the surrounding area. During the breeding season, clearing of trees or vegetation could result in destruction of nests, adversely impacting some individuals. However, lasting impacts to local breeding populations are not anticipated. Tree and shrub removal work would occur before May 1 and after August 15, as feasible (see COP Table ES-1), to avoid the potential disturbance of birds during the breeding season. If tree and shrub removal cannot be avoided during this season, Revolution Wind would coordinate with the appropriate agencies to determine the appropriate course of action. Visible structures (i.e., construction equipment) would be present during construction of the onshore facilities. Collisions between birds and vehicles or construction equipment have some limited potential to cause injury and mortality. However, these impacts, if any, would be temporary **negligible** adverse, as most individuals would avoid noisy construction areas (Bayne et al. 2008; Goodwin and Shriver 2010; McLaughlin and Kunc 2013). Therefore, impacts to birds from construction of onshore facilities would be short term **negligible** to **minor** adverse.

3.7.2.2.2 Operations and Maintenance and Decommissioning

Offshore Activities and Facilities

Accidental releases and discharges: Impacts to birds from this IPF during operation and decommissioning of the offshore facilities are expected would be similar to offshore construction impacts and result in short-term **negligible** to **minor** adverse impacts with compliance with the USCG requirements and BSEE regulations for the prevention and control of oil and fuel spills and adherence to federal, state, and local regulations regarding disposal of solid and liquid wastes.

Anchoring and new cable emplacement/maintenance: Other than temporary increases in turbidity from seafloor disturbance due to occasional vessel anchoring, no impacts to bird species are anticipated during the O&M phase for the offshore RWF or RWEC. Impacts from decommissioning would be similar to construction impacts unless the RWEC is abandoned in place: **negligible** adverse.

Climate change: The expected impacts on climate change from operation of the offshore facilities alone would not result in a measurable increase in the adverse impacts to birds beyond those described under the No Action Alternative. In addition, operation of the Proposed Action could also contribute to a long-term net decrease in GHG emissions and may beneficially contribute to a broader combination of actions to reduce future impacts to birds from climate change over the long term due to reduced reliance on fossil fuel–generated energy sources, but this change would likely not be measurable. Therefore, BOEM expects the impacts from the Proposed Action on climate change would be long term **negligible**.

Light: Under the Proposed Action, up to 100 WTGs and up to two OSSs would be lit with USCG navigational and FAA hazard lighting. These lights have some potential to attract birds and result in increased collision risk (Hüppop et al. 2006). However, the mandatory use of red flashing aviation obstruction lights and the avoidance of any steady-burning aviation obstruction lights are expected to minimize bird attraction and therefore collision risk (Kerlinger et al. 2010; Orr et al. 2016). For this reason, BOEM expects adverse impacts, if any, to be long term **negligible** adverse from offshore lighting.

Noise: Impacts to birds from operational noise and decommissioning of the offshore facilities would be similar to offshore construction impacts and result in **negligible** adverse impacts.

Presence of structures: Within the Atlantic Flyway along the North American Atlantic coast, much of the bird activity is concentrated along the coastline (Watts 2010). Waterbirds use a corridor between the coast and several kilometers out onto the Atlantic OCS, whereas land birds tend to use a wider corridor extending from the coastline to tens of kilometers inland (Watts 2010). However, operation of the Proposed Action would result in impacts on some individuals of offshore bird species and possibly some individuals of coastal and inland bird species during spring and fall migration. These impacts could arise through direct mortality from collisions with WTGs and/or through behavioral avoidance and habitat loss (Drewitt and Langston 2006; Fox et al. 2006; Goodale and Millman 2016). To reduce the collision risk with WTGs, Revolution Wind is committed to an indicative layout scenario with WTGs sited in a grid with a spacing of approximately 1.15 miles (1 nm) × 1.15 miles (1 nm) that aligns with other proposed adjacent offshore wind projects in the RI/MA WEA. This wide spacing of WTGs is expected to allow birds to avoid individual WTGs and minimize risk of potential collision (see COP Table ES-1).

In COP Appendix AA (bri 2021), vulnerability was assessed to determine how sensitive a bird population is to mortality or habitat loss related to the presence of a wind farm and in terms of collision vulnerability and displacement vulnerability. Factors considered in vulnerability assessments include vital rates, existing population trends, relative abundance, nocturnal flight activity, diurnal flight activity, avoidance, proportion of time within the RSZ, maneuverability in flight, percentage of time flying, and habitat flexibility. Avian flight heights were important in the assessment of behavioral vulnerability. Flight heights used in the assessment were gathered from OSAMP boat-based surveys (local) and datasets in the Northwest Atlantic Seabird Catalog (regional). Final exposure and vulnerability assessments for each taxonomic group and species are provided in Sections 3.4 through 3.10 of COP Appendix AA (bri 2021) and in Table 3-38 of COP Appendix AA (bri 2021).

The presence and operation of the offshore facilities may result in displacement of waterbirds, waterfowl, seabirds, and phalaropes that use the area for foraging, resting, or nighttime roosting. Some species can be displaced several kilometers outside the Lease Area (Welcker and Nehls 2016). Generally, the relative abundance of bird species that are most sensitive to displacement is low within the offshore portion of the Project during all seasons (bri 2021). These long-term adverse impacts would be **negligible** to **minor**, depending on whether birds are at high risk for displacement or are able to access preferred habitat, and these impacts may change over time if birds become habituated to the presence of the WTGs and OSSs. Impacts to birds from decommissioning of the RWF and offshore RWEC would be similar to those described for the construction phase.

The Lease Area is generally beyond the range of most breeding terrestrial or coastal bird species. Coastal birds that may forage in the Lease Area occasionally, visit the area sporadically, or pass through on their spring and/or fall migrations include shorebirds (e.g., sandpipers, plovers), waterbirds (e.g., cormorants, grebes), waterfowl (e.g., scoters, mergansers), wading birds (e.g., herons, egrets), raptors (e.g., falcons, eagles), and songbirds (e.g., warblers, sparrows). Overall, with the exception of migratory falcons and songbirds, coastal birds are considered to have minimal exposure to the Lease Area. Falcons, primarily peregrine falcons, may be exposed to the Lease Area. Some migratory songbirds, particularly the blackpoll warbler, may also be exposed to the Lease Area during fall migration, but population-level impacts are unlikely because exposure of the population to the Lease Area is expected to be minimal to low and limited to migration. Of the marine birds, loons, sea ducks, gulls, terns, and auks received up to a medium overall exposure assessment. Loons, sea ducks, gannets, and auks are documented to avoid wind farms, but displacement from the Lease Area is unlikely to affect populations because there is likely available foraging habitat outside the Lease Area (bri 2021).

Special-status bird species were also assessed, including golden eagle, bald eagle, red knot, piping plover, and roseate tern. The Project is not expected to affect special-status species populations. Golden and bald eagle exposure to the Lease Area is considered minimal because these species are rarely detected in the offshore environment. Red knots and piping plovers have the potential to be exposed only during migration, and vulnerability to collision is considered low because shorebirds fly substantially above the RSZ during migrations. Although tracked roseate terns were estimated to have passed through the northern portion of the Lease Area (bri 2021), individual impacts are unlikely because the birds were not detected in the Lease Area during surveys, and they would be primarily flying below the RSZ. A detailed analysis of the impacts from O&M and decommissioning of the offshore facilities on federally listed birds can be found in the BA (BOEM 2022).

Onshore Activities and Facilities

Accidental releases and discharges: The OnSS would require various oils, fuels, and lubricants to support its operation. As described above in Section 3.7.2.2.1, accidental discharges, releases, and disposal could indirectly cause bird habitat degradation; however, risks would be avoided through spill prevention and control measures and associated BMPs. Therefore, potential adverse impacts associated with discharges and releases are considered short term and localized **negligible** adverse.

Climate change: No measurable climate change impacts to birds from O&M of the onshore facilities are expected. Climate change impacts from decommissioning would be similar to those described for construction. Therefore, the adverse impacts from this IPF are expected to be long term **negligible** adverse.

Light: During the O&M of the OnSS and ICF, yard lighting would be used for assessment of equipment. In general, operational lighting would be limited to the minimum necessary to ensure safety and compliance with applicable regulations (see COP Table ES-1). Most decommissioning activities would occur during the day, and overnight lighting would only be necessary if there is work in progress on-site or lights are left on for safety and security purposes. Therefore, the adverse impacts resulting from this IPF would be long term **negligible**.

New cable emplacement/maintenance: Operation of the onshore transmission cable would pose no risk to birds because it would be buried. Land disturbance in the form of vegetation management would occur on a periodic basis to maintain vegetation at shrub height within the perimeters of the onshore facilities. Hazard tree removal would be performed on a cyclical basis to inspect and remove trees that may fail that are outside the edge of the maintained ROW. Land disturbance as it relates to vegetation clearing may result in the direct injury or mortality of birds. However, mortality and injury impacts would be mitigated by observing time-of-year restrictions on vegetation removal that would avoid the breeding season of bird species. Therefore, the adverse impacts resulting from this IPF would be **negligible**. Impacts from land disturbance during decommissioning would be similar to those described in Section 3.7.2.2.1, though the impacts would likely be less because new vegetation clearing, and grading would not be necessary.

Noise: According to the vhb (2021) onshore acoustic assessment, during O&M, the proposed OnSS and ICF would introduce new sources of sound, which is modeled to be 45.5 dBA (Leq) or less when measured at the nearest anthropogenic sensitive receptors and falls within the ambient sound range measured at baseline conditions. Temporary noise and construction-related traffic may occasionally be generated due to nonroutine maintenance. Pickup trucks or other automobiles would be used to make routine visits to the OnSS and ICF during O&M. Occasional maintenance and operational emergency visits may necessitate bucket trucks, cranes, and similar vehicles to facilitate these activities. Infrequent vehicle usage within the OnSS and ICF may create temporary noise-related disturbance to birds adjacent to the OnSS. However, such disturbance would be short term, and normal avian activity would likely resume after the traffic ceases. BOEM expects these adverse impacts to be **negligible**.

Presence of structures: The OnSS and ICF would be visible structures that would result in permanent bird habitat conversion and loss. The OnSS access road and fenced-in property would become nonhabitat and result in habitat fragmentation. The conversion of forested cover type outside the OnSS and ICF fences would alter the structural diversity within a forested area by adding more edge habitat. Considering the adjacent landscape consists primarily of residential and commercial developments with some undisturbed areas of ruderal forested swamp, the adverse impacts to birds from the OnSS and the ICF on forested habitat fragmentation would be long term **negligible** to **minor**.

This change in the visible landscape would present a very minor risk of mortality or injury to birds due to collision with the OnSS or ICF, and, generally, the changes to the habitat conditions would result in avoidance behavior and may influence bird habitat selection near these structures (e.g., breeding habitat for some forest-dependent species may be less suitable). These impact risks would exist throughout the O&M phase of the Project. The potential for avian mortality or injury due to the low risk of collision with the OnSS and related structures would be a long-term **minor** adverse impact. The potential for avian avoidance behavior related to habitat conversion and loss from the OnSS would also be a long-term **minor** adverse impact. If the footprint of the OnSS and ICF yards are left in place after they have been decommissioned and equipment has been removed, the remaining development would still be considered a visible structure because it would remain a hard structure within a forested area. Adverse impacts to birds from habitat fragmentation related to a visible change in the landscape during decommissioning would be **negligible** because local populations would have adapted to the landscape changes.

3.7.2.2.3 Cumulative Impacts

Offshore Activities and Facilities

Accidental releases and discharges: Future offshore wind activities would contribute to an increased risk of spills and associated impacts due to fuel, fluid, or hazmat exposure. The contribution from future offshore wind and the Proposed Action would be a low and non-measurable percentage of the overall spill risk from all ongoing offshore activities. In the context of reasonably foreseeable environmental trends, the combined impacts from this IPF from ongoing and planned actions, including the Proposed Action, would be likely limited in extent and duration and would result in localized and temporary **negligible** adverse cumulative impacts on birds.

Anchoring and new cable emplacement/maintenance: The Proposed Action would add 7,258 acres of seafloor disturbance from the operation of WTG foundations and scour protection, RWEC and IAC installation, and anchoring to the No Action Alternative, which equates to 31% of the total seafloor disturbance estimated under the No Action Alternative. This would result in localized turbidity effects that could reduce marine bird foraging success or impact marine bird prey species. However, individual birds would be expected to successfully forage in nearby areas not affected by increased turbidity, and only non-measurable **negligible** adverse impacts, if any, on individuals or populations would be expected given the localized and temporary nature of the potential impacts. In the context of reasonably foreseeable environmental trends, the combined cable emplacement impacts from ongoing and planned actions, including the Proposed Action, could occur if impacts are in close temporal and spatial proximity. However, these adverse impacts from anchoring and cable emplacement would be **negligible** and would not be biologically significant. For these reasons, the Proposed Action when combined with other past, present, and reasonably foreseeable projects would result in short-term **negligible** to **minor** cumulative adverse impacts to birds.

Climate change: The types of impacts from global climate change described for the No Action Alternative would occur under the Proposed Action. However, the Proposed Action could also contribute to a long-term net decrease in GHG emissions. This difference may not be measurable but would help reduce climate change impacts. Therefore, long-term **minor** adverse and long-term **negligible** beneficial cumulative impacts to birds are expected.

Light: The Proposed Action would add up to 100 new WTGs with red flashing aviation hazard lighting to the No Action Alternative; these lights could attract birds and result in increased collision risk (Hüppop et al. 2006). Additionally, marine navigation lighting would include one or more flashing white lights on each WTG and the OSSs and would be directed out and down to the water surface. Vessel lights during construction and installation, O&M, and decommissioning would be minimal and limited to vessels transiting to and from wind farm areas. Ongoing and future non–offshore wind activities are expected to cause short-term impacts, primarily from vessel lights. For these reasons, the Proposed Action when combined with past, present, and reasonably foreseeable activities would result in long-term **negligible** to **minor** adverse cumulative impacts to birds, and no individual or population-level impacts would be expected.

Noise: Pile driving and other construction noise and activity associated with the Proposed Action could add to baseline noise and activity associated with other offshore wind projects with overlapping construction periods. Potential impacts could be greater if avoidance and displacement of birds occur during seasonal migration periods. However, the Proposed Action's contribution to adverse noise impacts would be limited in duration, negligible, and cease when construction ends. No individual fitness (i.e., a bird's ability to survive and reproduce) or population-level effects would be expected. Therefore, the Proposed Action when combined with past, present, and reasonably foreseeable activities would result in **negligible** to **minor** adverse cumulative impacts to birds.

Presence of structures: The Proposed Action would add up to 100 additional WTGs and up to two OSSs compared to the No Action Alternative. The total cumulative foundations on the Atlantic OCS would be 3,110, and the Project would account for less than 4% of that total number. Adverse impacts to migration patterns or collision risk from these additional turbines would be negligible and would persist until decommissioning is complete. Additionally, beneficial impacts to foraging near offshore structures would similarly be negligible and persist for the life of the Project. Therefore, cumulative impacts on birds from the presence of structures associated with the Proposed Action when combined with past, present, and reasonably foreseeable activities would be long term **minor** adverse and long term **minor** beneficial.

Onshore Activities and Facilities

Accidental releases and discharges: Onshore construction activities and operation of the OnSS under the Proposed Action could result in the accidental releases of fuel, fluids, or hazmat; sediment; and/or trash and debris. These releases, if any, would occur infrequently at discrete locations and vary widely in space and time. Ongoing and future onshore activities could contribute to impacts to birds from accidental releases if they occur at the same time within the GAA. However, incidences such as these would be mitigated by implementation of project-specific SPCC plans. In the context of reasonably foreseeable environmental trends, the combined impacts from this IPF from ongoing and planned actions, including the Proposed Action, would be localized and temporary due to the likely limited extent and duration of a release and result in **negligible** adverse cumulative impacts to birds.

Climate change: The types of impacts from global climate change described for the No Action Alternative would occur under the Proposed Action, but no measurable change from the operational impacts of onshore activities and facilities to birds under the No Action Alternative is anticipated. Therefore, the combined impacts from this IPF from ongoing and planned actions, including the Proposed Action and cumulative impacts, are expected to be long term **minor** adverse.

Light: Lighting used during construction of the Proposed Action would be limited to the minimum required for safety. Operational lighting would be limited to the minimum necessary to ensure safety and compliance with applicable regulations (see COP Table ES-1). Decommissioning activities would primarily occur during the day, and overnight lighting is not expected. Therefore, impacts to birds from the Proposed Action would be localized and temporary **negligible** to **minor** adverse. Ongoing and future onshore activities could contribute to impacts to birds from light if they occur at the same time within the GAA. However, these effects are also expected to be localized and temporary and would not contribute to adverse cumulative impacts to birds in the GAA.

New cable emplacement/maintenance: The Proposed Action would result in temporary ground disturbance from installation of the onshore transmission cable and construction at the landfall work area. Most of this temporary ground disturbance would occur in previously disturbed areas along paved roads or parking lots and would not result in impacts to bird habitat. Operation of the onshore transmission cable would pose no risk to birds because it would be buried, and no other impacts to bird species are anticipated during routine onshore operations. Therefore, the contribution of the Proposed Action on adverse cumulative impacts to birds from new cable emplacement or maintenance in the context of reasonably foreseeable onshore environmental trends within the GAA is expected to be **negligible** adverse.

Noise: Onshore construction activities would add to onshore noise, resulting in localized and temporary impacts to birds (i.e., avoidance and displacement), particularly if ongoing and planned onshore activities overlap with the Proposed Action in space and time. Normal operation of the OnSS would generate continuous noise. However, BOEM expects long-term **negligible** adverse impacts when considered in the context of the other commercial and industrial noises nearby. Therefore, in the context of reasonably foreseeable environmental trends, the combined impacts from this IPF from ongoing and planned actions, including the Proposed Action, would be localized and temporary due to the likely limited extent and duration of noise and would result in **negligible** adverse cumulative impacts to birds.

Presence of structures: The Proposed Action would result in the permanent conversion, loss, and fragmentation of onshore bird habitat through the removal of forested cover types for construction of the OnSS and the ICF. These actions could result in localized and temporary impacts to birds, including avoidance and displacement, although no individual fitness or population-level effects would be expected. These changes would have a **negligible** adverse effect on birds because forested habitat is common within the surrounding area. In addition, the permanent onshore facilities (ICF and OnSS) would be located on the edge of previously developed areas. The presence of these structures when considered in the context of ongoing and planned actions within the GAA would be a very minor risk of mortality or injury to birds due to collision, and generally, the changes to the habitat conditions would result in avoidance behavior and may influence bird habitat selection. Therefore, BOEM anticipates long-term **negligible** to **minor** adverse cumulative impacts to birds.

3.7.2.2.4 Conclusions

Project construction and installation and decommissioning would introduce noise, lighting, human activity, debris and contaminants, and new structures and vessels (increasing potential collision risk) to the GAA as well as alter existing bird habitat. Noise, lighting, and human activity impacts from Project

O&M would occur, although at lower levels than those produced during construction and decommissioning. Offshore structures would also represent a long-term collision risk. BOEM anticipates the impacts resulting from the Proposed Action alone would range from **negligible** to **minor** adverse for the duration of the Project. Therefore, BOEM expects the overall impact on birds from the Proposed Action alone to be long term **minor** adverse; however, the resource would recover completely after decommissioning without remedial or mitigating action.

In the context with other reasonably foreseeable environmental trends and planned actions, the impacts under the Proposed Action resulting from individual IPFs would range from temporary to long term **negligible** to **minor** adverse as well as long term **negligible** beneficial. Considering all the IPFs together, BOEM anticipates that the overall impacts associated with the Proposed Action when combined with past, present, and reasonably foreseeable activities would result in **minor** cumulative adverse impacts to birds. This determination is because the impacts would not be expected to result in noticeable change to the condition of birds in the GAA, and the populations would recover completely without remedial or mitigating action.

3.7.2.3 Alternatives C, D, E, and F

Table 3.7-2 provides an analysis of all evaluated IPFs for birds across these alternatives.

3.7.2.3.1 Conclusions

Although Alternatives C through F would reduce the number of WTGs and their associated IACs, which would have an associated reduction in potential collision risk, BOEM expects that the impacts to birds resulting from the alternative alone would be similar to the Proposed Action and range from **negligible** to **minor** adverse.

In the context of other reasonably foreseeable environmental trends and planned actions, BOEM also expects that Alternatives C through F's impacts would be similar to the Proposed Action (with individual IPFs leading to impacts ranging from **negligible** to **minor** adverse and **minor** beneficial). The overall impacts of Alternatives C through F when combined with past, present, and reasonably foreseeable activities would therefore be the same level as under the Proposed Action: **minor** adverse.

3.7.2.4 Mitigation

Use of bird-deterrent devices and conducting marine construction activities during approved in-water work windows, which would be developed in consultation with NMFS and USFWS, would further reduce the expected negligible to minor long-term impacts on birds by minimizing bird attraction to operating WTGs and OSSs (see Table F-2 in Appendix F for details). Implementation of Revolution Wind's *Avian and Bat Post- Construction Monitoring Framework* (see Appendix G and COP Appendix AA) would not reduce impacts; however, the data gathered from the monitoring would be used to evaluate impacts and potentially lead to additional mitigation measures, if required (30 CFR 585.633(b)). If the reported postconstruction bird and bat monitoring results indicate bird and bat impacts deviate substantially from the impact analysis included in this EIS, then Revolution Wind would be required to recommend new mitigation measures or monitoring methods.

3.8 Coastal Habitats and Fauna

3.8.1 Description of the Affected Environment and Environmental Consequences of the No Action Alternative for Coastal Habitats and Fauna

Geographic analysis area: The GAA for coastal habitats and fauna (see Figure 3.8-1) comprises the construction footprints for the following onshore project components: the onshore transmission cable, landfall work area, OnSS, and ICF. The coastal habitats within the GAA include the area from state waters inland to the mainland, including the foreshore, backshore, dunes, and interdunal areas. Aquatic habitats are discussed in Section 3.21 and Section 3.6. Offshore components of the proposed Project would not impact coastal habitat and fauna other than certain avian and bat species, which are discussed in Section 3.7 and Section 3.5, respectively.

Affected environment: Appendix K of the COP includes the results of field investigations conducted for the Project's onshore facilities as well as descriptions of habitats, delineations of freshwater and coastal wetlands, identification of plant and wildlife species, records of rare species observations, and observations of invasive species (vhb 2021). Plant communities were documented by vhb and compared to the key habitat profiles provided in the RIWAP (Rhode Island DEM et al. 2015) to assign the appropriate plant communities within the analysis area. These plant communities are provided in Table 3.8-1 and described below. "Native coastal fauna" is defined herein as terrestrial mammals, reptiles, amphibians, and terrestrial and intertidal invertebrates. Most of the GAA for coastal habitats and fauna is disturbed from previous anthropogenic uses. Therefore, habitat quality and the potential suitability for use by fauna have been degraded. However, several key habitats, as identified in the RIWAP (Rhode Island DEM et al. 2015), suitable to a range of wildlife and plant species are present in the GAA. Invasive plant species are prevalent throughout the GAA because of prior anthropogenic disturbance (vhb 2021). vhb identified habitat for a variety of terrestrial mammals, reptiles, and amphibians during habitat assessment surveys conducted July 30, August 14, September 3, and December 10, 2019, and March 27 and July 13, 2020.

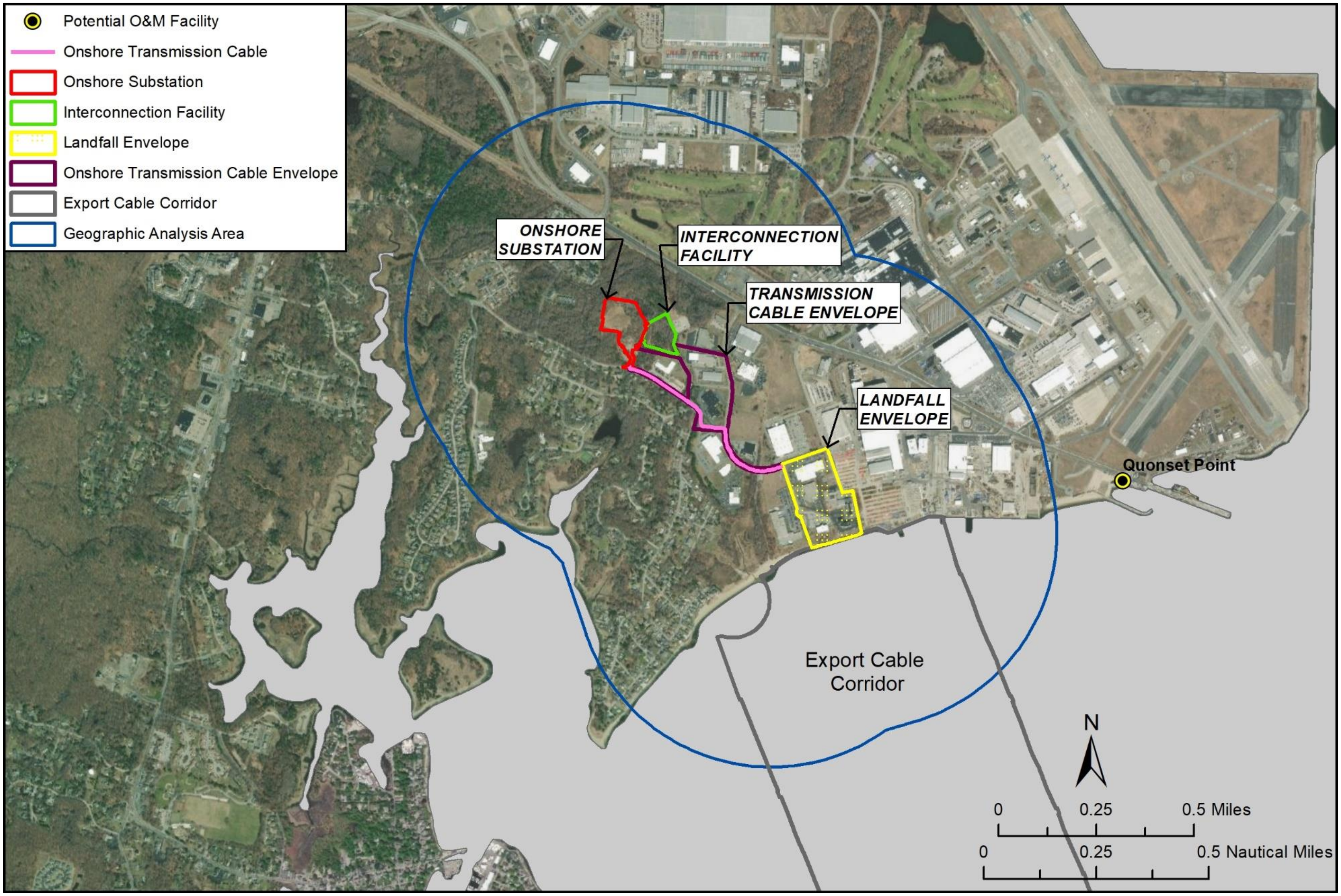

Figure 3.8-1. Geographic analysis area for coastal habitats and fauna.

Table 3.8-1. Plant Communities in the Geographic Analysis Area for Coastal Habitats and Fauna

Plant Community	Area in the Geographic Analysis Area (acres)
Landfall Work Area	
Modified coastal beach	0.330
Ruderal grassland/shrubland	1.300
OnSS	
Mixed oak/white pine forest	3.800
Capped landfill	2.600
Pitch pine barren	0.600
Ruderal shrub marsh	0.001
ICF	
Mixed oak/white pine forest	3.500
Ruderal forested swamp	0.100
Ruderal grassland/shrubland	0.050
Ruderal shrub marsh	0.010
Transmission Cable Envelope	
Mixed oak/white pine forest	0.560
Softwood forest	0.320
Mowed lawn	0.020
Ruderal grassland/shrubland	0.020
Oak forest	0.008
Pitch pine barren	0.006

Source: vhb (2021); Rhode Island DEM et al. (2015)

Landfall Work Area

The modified coastal beach plant community comprises areas within the landfall work area that have been altered by placement of seawalls and riprap revetments, which expose the sandy beach during low tides. Vegetation at the base of the seawall and along the top of the seawall includes spotted knapweed (*Centaurea maculosa*), an invasive species; common milkweed (*Asclepias syriaca*); prickly lettuce (*Lactuca serriola*); and American pokeweed (*Phytolacca americana*). Adjacent to areas of modified coastal beach, the landfall work area contains ruderal grassland/shrubland. Ruderal grasslands/shrublands constitute early successional habitats defined by Anderson et al. (1976) as uplands where the potential natural vegetation is predominantly grasses, grasslike plants, forbs, or shrubs. Such habitats are typically anthropogenically created or maintained due to management strategies. The vegetation within ruderal grassland/shrubland areas is similar to the species composition along the seawall described above and also includes northern bayberry (*Myrica pensylvanica*) and eastern red cedar (*Juniperus virginiana*) (vhb 2021).

Transmission Cable Envelope

The transmission cable envelope is comprised primarily of industrial and residential land uses and consists of lots with managed lawns. Although managed lawn is not considered a key habitat by the RIWAP, it provides limited utility to some species of wildlife (e.g., passerines and rodents) in an otherwise heavily developed industrial and commercial area. It should be noted that some of these lots containing only managed lawn may be designated for future development (vhb 2021). The preferred transmission cable route is an approximate 1 mile (1.6 km) route that would predominantly follow along paved roads or previously disturbed areas such as parking lots.

Some of the alternative routes under consideration within the transmission cable envelope contain segments that would pass through undeveloped, vegetated areas and would be approximately the same length. Alternative transmission cable routes would pass a vacant lot that supports a dry ruderal grassland/shrubland field that gently slopes downward toward an access path. This plant community supports a mix of shrubs and herbaceous forbs and grasses, including eastern red cedar, pitch pine (*Pinus rigida*), *Yucca* sp., Virginia creeper (*Parthenocissus quinquefolia*), and common milkweed. The ruderal grassland/shrubland supports some invasive species, including autumn olive (*Elaeagnus umbellate*), Morrow's honeysuckle (*Lonicera morrowii*), Asiatic bittersweet (*Celastrus orbiculatus*), and mugwort (*Artemisia* sp.). Alternative onshore cable transmission routes would also pass through upland forest and shrubland. Vegetation within this area shows signs of anthropogenic disturbance and is composed of a ruderal mixed oak/white pine forest with a shrubby understory. Dominant vegetation within the canopy layer includes eastern white pine (*Pinus strobus*), red oak (*Quercus rubra*), white oak (*Quercus alba*), and eastern red cedar. Dominant species within the shrub and herb stratum include autumn olive, Morrow's honeysuckle, Asiatic bittersweet, multiflora rose (Rosa multiflora), green briar (*Smilax rotundifolia*), garlic mustard (*Alliaria petiolata*), and poison ivy (*Toxicodendron radicans*) (vhb 2021).

Onshore Substation and Interconnection Facility

The primary plant community within the footprint of both the OnSS and the ICF is mixed oak/white pine forest. Dominant species within the canopy include red oak, black oak (*Quercus velutina*), scarlet oak (*Quercus coccinea*), and eastern white pine, and other canopy species include red maple, black cherry *(Prunus serotina*), and black birch (*Betula lenta*). Understory vegetation includes Morrow's honeysuckle, common greenbrier, Virginia creeper, and spotted wintergreen (*Chimaphila maculata*). As with the adjoining ruderal forested swamp that occurs within the OnSS footprint (described below), the oak and white pine forest shows signs of human disturbance from its previous use as a landfill.

Ruderal forested swamp is also present within the OnSS footprint. The dominant canopy species within the forested swamp is red maple (*Acer rubrum*) with scattered patches of black gum (*Nyssa sylvatica*), swamp white oak (*Quercus bicolor*), red oak, and eastern white pine. The understory contains scattered sapling recruitment from the canopy layer and shrub thickets of sweet pepperbush (*Clethra alnifolia*), highbush blueberry (*Vaccinium corymbosum*), winterberry (*Ilex verticillata*), and alder (*Alnus* sp.). Poison ivy, green briar, sensitive fern (*Onoclea sensibilis*), and skunk cabbage (*Symplocarpus foetidus*) are common in the herbaceous stratum. A ruderal shrub marsh is present in the northern part of the OnSS footprint. The southern boundary of the marsh is highly altered, with demolition debris stacked along slopes above the marsh. The northern limit of the marsh extends beyond the OnSS footprint based on available topographic mapping and aerial photographs. The ruderal shrub marsh has a forested perimeter, and open water seasonally inundates the shrubland cover type (vhb 2021).

A large area (2.6 acres) within the OnSS footprint is considered capped landfill because of the alterations associated with the former Camp Avenue Dump, which is listed on the Superfund Enterprise Management System database as a State Hazardous Waste Site. From approximately 1949 to 1953, and as late as 1970, the Camp Avenue Dump was used as a general landfill by the U.S. Navy before the Quonset Point Naval Air Station was deactivated in 1974. Previous studies conducted at the dump, as well as field observations during Project surveys, reported wastes such as construction debris, roofing tar, ship parts, and unspecified industrial waste (vhb 2020a). Evidence of the site's past use as a landfill is present throughout with fill artifacts, disturbed topography that indicates previous cutting and filling, and pervasive invasive vegetation that includes glossy buckthorn (Frangula alnus), Asiatic bittersweet, Morrow's honeysuckle, black locust (Robinia pseudoacacia), multiflora rose, privet (Ligustrum sp.), tree of heaven (*Ailanthus altissima*), black swallow-wort (*Cynanchum louiseae*), mugwort, and garlic mustard (vhb 2021).

General wildlife records for the GAA are based on observations made during vhb's field investigations in July, August, September, and December 2019 and March and July 2020; the review of the RIWAP for species tied to specific key habitats within the GAA; and other pertinent literature, including *New England Wildlife: Habitat, Natural History, and Distribution* (DeGraaf and Yamasaki 2001). Appendix C in COP Appendix K (vhb 2021) provides a list of wildlife species observed during field investigations and species with the potential to occur within the GAA based on habitat preferences and habitat availability.

vhb evaluated information from the USFWS IPaC tool and the Rhode Island DEM ERM to assess if any federal or state-listed species; rare, threatened, or endangered species; or species of greatest conservation need were present within the analysis area. During field investigations for the onshore transmission cable, butterfly milkweed (*Asclepias tuberosa*), a Rhode Island state species of concern was recorded. Butterfly milkweed has showy orange flowers in umbels and occurs within disturbed habitats, grassland, meadows, and fields. As with other milkweed species, this plant provides important food sources for the larval form of butterfly species. This includes the monarch butterfly (*Danaus plexippus*), which is a candidate species under the federal ESA (Monarch Joint Venture 2019; USFWS 2019). In accordance with Rhode Island Natural Heritage Program (RINHP) policy, the occurrence of butterfly milkweed within these habitats will be reported to the RINHP during the state permitting process. No other federal or state-listed species; rare, threatened, or endangered species; species of greatest conservation need; or associated critical habitats, other than those discussed in Sections 3.5 and 3.7, were identified as having the potential to occur within the GAA for coastal habitats and fauna (BOEM 2022; vhb 2021).

3.8.1.1 Future Offshore Wind Activities (without Proposed Action)

Onshore Activities and Facilities

This section discloses potential coastal habitats and fauna impacts associated with future offshore wind development. Analysis of impacts associated with ongoing activities and future non–offshore wind activities is provided in Appendix E1.

Climate change: Impacts of climate change could contribute to impacts on coastal habitats and fauna primarily according to existing global and regional climate trends. Activities that contribute to climate change are provided in the Air emissions and climate change section in Section 3.4.1.1. Although sources of GHG emissions contributing to regional and global climate change mostly occur outside the GAA for coastal habitats and fauna, these resources may be affected by climate change, sea level rise, more frequent and intense storms, and altered habitat. Although the impacts resulting from climate change on coastal habitats and fauna are uncertain, BOEM anticipates that future offshore wind activities, without the Proposed Action, could have **negligible** adverse impacts on onshore coastal habitats and fauna.

Presence of structures: In addition to electrical infrastructure, some habitat conversion may result from port expansion activities required to meet the demands for fabrication, construction, transportation, and installation of wind energy structures as well as onshore substations and associated facilities. The general trend along the coastal region from Virginia to Maine is that port activity will increase modestly and require some conversion of undeveloped land to meet port demand and will result in permanent loss of forested habitat for local bat populations. However, the increase from future offshore wind development would be a minimal contribution in the port expansion required to meet increased commercial, industrial, and recreational demand (BOEM 2019b). The current bearing capacity of existing ports is considered suitable for wind turbines, requiring no port modifications for supporting offshore wind energy development (DOE 2014). Land disturbance for construction of onshore substations, associated facilities, and port expansion activities in the GAA is expected to result in **negligible** to **minor** adverse impacts to coastal habitat and fauna.

3.8.1.2 Conclusions

Under the No Action Alternative, coastal habitats and fauna would continue to follow current regional trends and respond to current and future environmental and societal activities. The current state of local coastal habitat and fauna resources is generally stable, although some fauna may be subject to disturbance from ongoing activities in the GAA. For example, land disturbance from onshore construction of cables and structures periodically causes temporary and permanent habitat loss, temporary displacement, injury, and mortality, resulting in small short-term impacts on certain coastal fauna species. Climate change, influenced in part by GHG emissions, is altering the seasonal timing and patterns of certain species' distribution and ecological relationships, likely causing permanent impacts of unknown intensity. Considering current conditions and the modest pace of development in the GAA, coastal fauna resources are expected to remain generally stable under the No Action Alternative.

BOEM anticipates that the impacts of ongoing activities, especially onshore construction and climate change, would be negligible. In addition to ongoing activities, planned actions other than offshore wind may also contribute to impacts on coastal habitats and fauna. Planned actions other than offshore wind primarily consist of increasing onshore construction, although no future construction projects were identified within the GAA. BOEM anticipates that the impacts of planned actions other than offshore wind would be **negligible** adverse.

If any onshore components of future offshore wind activities overlap the GAA, impacts such as displacement, mortality, and/or habitat loss would be similar to those resulting from the proposed Project alone. Considering all the IPFs together, BOEM anticipates that the overall impacts associated with future offshore wind activities combined with ongoing activities, reasonably foreseeable environmental trends, and planned actions other than offshore wind in the GAA would result in **negligible** to **minor** adverse impacts, primarily through onshore construction (most are attributable to ongoing activities) and climate change.

3.8.2 Environmental Consequences

3.8.2.1 Relevant Design Parameters, Impact-Producing Factors, and Potential Variances in Impacts

This assessment analyzes the maximum-case scenario; however, there is the potential for variances in the proposed Project build-out, as defined in the PDE (see Appendix D). The Project design parameters that would influence the magnitude of the impacts on coastal habitats and fauna include the location of the OnSS and ICF, the location of construction within the landfall work area and within the transmission cable envelope, and the time of year during which construction occurs. For example, the summer and fall months (May through October) constitute the most active season for coastal fauna in this area, especially reptiles and amphibians. Therefore, construction during months in which coastal fauna are not present, not breeding, or less active would have fewer impacts than construction during more active times.

The following EPMs would be implemented to minimize potential impacts to coastal habitats and fauna:

- Revolution Wind evaluated siting alternatives for the OnSS using the criteria that included avoidance or minimization of disturbance to ecologically sensitive areas.
- The OnSS and ICF would be located on parcels that are already highly altered and include buried demolition waste.
- The transmission cable would be located primarily in unvegetated and previously disturbed or developed ROWs.

These EPMs would be implemented across all alternatives; therefore, BOEM would not expect measurable potential variances in impacts across the alternatives.

See Appendix E1 for a summary of IPFs analyzed for coastal habitats and fauna across all action alternatives. IPFs that are either not applicable to the resource or determined by BOEM to have a negligible adverse effect are excluded from Chapter 3 and provided in Table E2-1 in Appendix E1. Offshore and onshore IPFs are addressed separately in the analysis if appropriate for the resource; not all IPFs have both an offshore and onshore component. Where feasible, calculations for specific alternative impacts are provided in Appendix E4, to facilitate reader comparison across alternatives.

Table 3.8-2 provides a summary of IPF findings carried forward for analysis in this section. Each alternative analysis discussion consists of the construction and installation phase, the O&M phase, the decommissioning phase, and the cumulative analysis. If these analyses are not substantially different, then they are presented as one discussion.

A detailed analysis of the Proposed Action is provided following the table. Detailed analysis of other considered action alternatives is also provided below the table if analysis indicates that the alternative(s) would result in substantially different impacts than the Proposed Action.

The Conclusion section within each alternative analysis discussion includes rationale for the overall effect call determination for that alternative. The overall impact of any alternative would be **minor** adverse because the effects on coastal habitats and fauna would be small, and the resource would be expected to recover completely, with no mitigation required.

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Table 3.8-2. Alternative Comparison Summary for Coastal Habitats and Fauna

Impact-Producing Factor	No Action Alternative	Alternative B (Proposed Action) up to 100 WTGs	Alternative C (Habitat Alternative) 64–65 WTGs	Alternative D (Transit Alternative) 78–93 WTGs	Alternative E (Viewshed Alternative) 64–81 WTGs	Alternative F (Higher Capacity Turbine Alternative) 56 WTGs
Climate change	**Onshore**: Impacts of climate change could contribute to impacts on coastal habitats and fauna primarily according to existing global and regional climate trends. Although the impacts resulting from climate change on coastal habitats and fauna are uncertain, BOEM anticipates that future offshore wind activities, without the Proposed Action, could have **negligible** adverse impacts on onshore coastal habitats and fauna.	**Onshore**: Climate change would contribute to impacts on coastal habitats and fauna primarily according to existing global and regional climate trends. The Proposed Action could contribute to a long-term net decrease in GHG emissions. This difference may not be measurable but would help reduce climate change impacts. Although the impacts resulting from climate change on coastal habitats and fauna are uncertain, BOEM anticipates that the Proposed Action would have no measurable influence on climate change and therefore the resulting impacts to coastal habitats and fauna would be **negligible** adverse. No additional impacts from climate change beyond those discussed under the impacts analysis for construction and installation are expected during O&M and Project decommissioning. The types of cumulative impacts from global climate change to coastal habitats and fauna described under the No Action Alternative would occur under the Proposed Action. However, the Project could also contribute to a long-term net decrease in GHG emissions. This difference may not be measurable but would help reduce climate change impacts (although effects would still be **negligible** to **minor** adverse).	**Onshore**: Alternatives C through F would not alter impacts to onshore activities. Therefore, construction, O&M and Project decommissioning impacts would be the same as those described for the Proposed Action: **negligible** adverse. Cumulative impacts would also be the same as those described for the Proposed Action: **negligible** to **minor** adverse.			
Presence of structures	**Onshore**: In addition to electrical infrastructure, some habitat conversion may result from port expansion activities required to meet the demands for fabrication, construction, transportation, and installation of wind energy structures as well as onshore substations and associated facilities. Land disturbance for construction of onshore substations, associated facilities, and port expansion activities in the GAA is expected to result in **negligible** to **minor** adverse impacts to coastal habitat and fauna.	**Onshore**: The operational footprints of the OnSS and ICF would create habitat loss when forested upland is cleared and replaced with hard structures and crushed gravel yards that are not capable of supporting plants or wildlife. The ICF would result in a loss of approximately 1.6 acres of mixed oak/white pine forest, which is reflective of the operational footprint of the ICF. The OnSS would result in a loss of 3.8 acres of mixed oak/white pine forest. Together, these losses represent a relatively small fraction of the 52 acres of contiguous habitat identified in the RIWAP (vhb 2021) and represent a **negligible** to **minor** adverse impact to coastal habitats. Overall, the habitat loss that would result from the construction of the OnSS and ICF would be considered negligible because this loss would be small relative to the unimpacted similar habitat in the general region. At the OnSS and ICF, land disturbance in the form of vegetation management would occur on a periodic basis to maintain vegetation at shrub height. Presence of structures as it relates to vegetation clearing may result in the direct injury or mortality of wildlife as well as habitat alteration or removal. Impacts from vegetation management may include reduction in habitat quality via the spread of invasive species and temporary displacement of individuals. However, the spread of invasive species would be controlled with periodic vegetation management, and wildlife displacement could occur only during vegetation removal activities. The impact of habitat degradation and wildlife displacement resulting from vegetation management of the OnSS and ICF is expected to be short term **negligible** adverse. The impact of habitat degradation and/or loss, wildlife displacement, and wildlife injury and/or mortality resulting from land disturbance during decommissioning of the OnSS and ICF would be short term **negligible** adverse. Because of the small amount of affected onshore habitat, land disturbance from the Proposed Action when added to other past, present, and reasonably foreseeable projects would result in **negligible** to **minor** adverse cumulative impacts to coastal habitats and fauna.	**Onshore**: Alternatives C through F would not alter impacts to onshore activities. Therefore, construction, O&M and Project decommissioning impacts would be the same as those described for the Proposed Action: **negligible** to **minor** adverse. Cumulative impacts would also be the same as those described for the Proposed Action: **negligible** to **minor** adverse.			

Note: Each cell includes analysis for the construction and installation phase, the O&M phase, the decommissioning phase, and the cumulative analysis. If these analyses are not substantially different, then they are presented as one discussion.

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3.8.2.2 Alternative B: Impacts of the Proposed Action on Coastal Habitats and Fauna

3.8.2.2.1 Construction and Installation

Onshore Activities and Facilities

<u>Climate change:</u> Climate change would contribute to impacts on coastal habitats and fauna primarily according to existing global and regional climate trends. Although sources of GHG emissions contributing to regional and global climate change mostly occur outside the GAA for coastal habitats and fauna, these resources may be affected by climate change, sea level rise, more frequent and intense storms, and altered habitat. The Proposed Action could contribute to a long-term net decrease in GHG emissions. This difference may not be measurable but would help reduce climate change impacts. Although the impacts resulting from climate change on coastal habitats and fauna are uncertain, BOEM anticipates that the Proposed Action would have no measurable influence on climate change and therefore the resulting impacts to coastal habitats and fauna would be **negligible** adverse.

<u>Presence of structures:</u> The OnSS would occupy an operational footprint measuring up to 3.8 acres and would connect to the ICF with two 115-kV underground transmission cables up to 527 feet long. Additionally, the OnSS would include a compacted gravel driveway, stormwater management features, and associated landscaped or managed vegetated areas totaling up to 7.1 acres inclusive of the up-to-4-acre operational footprint of the facility. The adjacent ICF would have an operational footprint of 1.6 acres and would also include a paved access road, stormwater management features, and associated landscaped or managed vegetated areas within the approximate 4.0-acre construction footprint. Construction of these facilities would result in habitat loss and habitat conversion in the areas surrounding the RWEC, the OnSS, and the ICF. The operational footprints of the OnSS and ICF would create habitat loss when forested upland is cleared and replaced with hard structures and crushed gravel yards that are not capable of supporting plants or wildlife. The ICF would result in a loss of approximately 1.6 acres of mixed oak/white pine forest, which is reflective of the operational footprint of the ICF. The OnSS would result in a loss of 3.8 acres of mixed oak/white pine forest. Together, these losses represent a relatively small fraction of the 52 acres of contiguous habitat identified in the RIWAP (vhb 2021) and represent a **negligible** to **minor** adverse impact to coastal habitats.

In addition to impacts on the mixed oak and white pine forest, the OnSS would develop 0.6 acre of pitch pine barren. The OnSS has been designed to avoid occurrences of sickle-leaved golden aster (*Pityopsis falcata*), a plant species of state concern within Rhode Island that were observed within the pitch pine barren outside of the footprint of the OnSS (vhb 2021). In accordance with the state environmental permitting needed for the Project, the occurrence of this state-listed species must be reported to the Rhode Island DEM, which will advise if a mitigation plan will be needed. Overall, the habitat loss that would result from the construction of the OnSS and ICF would be considered negligible because this loss would be small relative to the unimpacted similar habitat in the general region. As previously described in the impacts discussion for the landfall work area, land disturbance and habitat alteration from the construction of the OnSS and ICF could cause habitat degradation through the spread of invasive species. As noted previously, invasive plant growth within the OnSS parcels is pervasive. Invasive plant species were also observed throughout the forested portion of the ICF parcel (vhb 2021). This observation indicates that invasive species are likely to become further established in these areas if proper management techniques are not followed.

3.8.2.2.2 Operations and Maintenance and Decommissioning

Onshore Activities and Facilities

Climate change: No additional impacts from climate change beyond those discussed under the impacts analysis for construction and installation described in Section 3.8.2.2.1 are expected during O&M and Project decommissioning. BOEM anticipates that the Proposed Action would have no measurable influence on climate change and therefore the resulting impacts to coastal habitats and fauna would be **negligible** adverse.

Presence of structures: At the OnSS and ICF, land disturbance in the form of vegetation management would occur on a periodic basis to maintain vegetation at shrub height. Vegetation control methods would employ integrated vegetation management practices, including manual cutting, mowing, the prescriptive use of herbicides, and the use of environmental and cultural controls (Eversource 2018). The method of control would be determined following inspections of the site scheduled for maintenance. The current maintenance cycle for vegetation control using integrated vegetation management practices is 3 or 4 years depending on the vegetation composition, facilities, and site conditions (Eversource 2018). Hazard tree removal would also be performed on a cyclical basis to inspect and remove trees that may fall that are outside the edge of maintained ROWs. Presence of structures as it relates to vegetation clearing may result in the direct injury or mortality of wildlife as well as habitat alteration or removal. Impacts from vegetation management may include reduction in habitat quality via the spread of invasive species and temporary displacement of individuals. However, the spread of invasive species would be controlled with periodic vegetation management, and wildlife displacement could occur only during vegetation removal activities. The impact of habitat degradation and wildlife displacement resulting from vegetation management of the OnSS and ICF is expected to be short term **negligible** adverse.

At the end of the Project's operational life, the OnSS and ICF would be decommissioned in accordance with a detailed Project decommissioning plan that would be developed at that time. OnSS and ICF equipment may be removed while keeping the substation yard and fencing intact. Under such a scenario, land disturbance and habitat alteration activities may be similar to those described under the construction impact analysis, although the impacts would likely be less because new vegetation clearing and grading would not be necessary. The impact of habitat degradation and/or loss, wildlife displacement, and wildlife injury and/or mortality resulting from land disturbance during decommissioning of the OnSS and ICF would be short term **negligible** adverse.

3.8.2.2.3 Cumulative Impacts

Onshore Activities and Facilities

Climate change: The types of cumulative impacts from global climate change to coastal habitats and fauna described under the No Action Alternative would occur under the Proposed Action. However, the Project could also contribute to a long-term net decrease in GHG emissions. This difference may not be measurable but would help reduce climate change impacts (although effects would still be **negligible** to **minor** adverse).

Presence of structures: Construction and installation, O&M, and decommissioning of the OnSS under the Proposed Action would contribute to the habitat conversion and habitat loss described under the No Action Alternative, potentially changing the composition and abundance of faunal assemblages through the removal of forested habitat at the OnSS and ICF. Because of the small amount of affected onshore habitat, land disturbance from the Proposed Action when added to other past, present, and reasonably foreseeable projects would result in **negligible** to **minor** adverse cumulative impacts to coastal habitats and fauna.

3.8.2.2.4 Conclusions

In summary, the activities associated with the Proposed Action may affect coastal habitats and fauna through temporary land disturbance, injury or mortality of individuals, and permanent conversion of a small proportion of the overall habitat available regionally. Considering the avoidance, minimization, and mitigation measures proposed, construction of the Proposed Action alone would likely have negligible to minor impacts on coastal habitats and fauna. The Proposed Action would contribute to the cumulative impact rating primarily through the temporary displacement, mortality, temporary to permanent habitat loss, and noise generated from construction of the OnSS and ICF. Considering all the IPFs together, BOEM anticipates that the impacts to coastal habitats and fauna from ongoing and planned actions, including the Proposed Action, would likely be **minor** adverse in the GAA because the measurable impacts expected would be small and/or the resource would likely recover completely when the impacting agent is gone and remedial or mitigating action is taken. The main drivers for this impact rating are ongoing and future land disturbance and ongoing climate change.

3.8.2.3 Alternatives C, D, E, and F

Table 3.8-2 provides a summary of IPF findings for these alternatives.

3.8.2.3.1 Conclusions

The overall impacts of Alternatives C through F to coastal habitats and fauna when combined with past, present, and reasonably foreseeable activities would be the same as under the Proposed Action: **minor** adverse.

3.8.2.4 Mitigation

No potential additional mitigation measures for coastal habitats and fauna are identified in Table F-2 in Appendix F.

3.9 Commercial Fisheries and For-Hire Recreational Fishing (see section in main EIS)

3.10 Cultural Resources (see section in main EIS)

3.11 Demographics, Employment, and Economics (see section in main EIS)

3.12 Environmental Justice (see section in main EIS)

3.13 Finfish and Essential Fish Habitat (see section in main EIS)

3.14 Land Use and Coastal Infrastructure

3.14.1 Description of the Affected Environment and Environmental Consequences of the No Action Alternative for Land Use and Coastal Infrastructure

Geographic analysis area: The GAA for land use and coastal infrastructure is the Town of North Kingstown, Rhode Island, and the ports potentially used for Project construction and installation, O&M, and decommissioning. The ports included as part of the GAA include port facilities and surrounding areas at Sparrow's Point, Paulsboro Marine Terminal, Port of Brooklyn, Port Jefferson, Port of Montauk, Port of New London, Port of Davisville at Quonset Point, Port of Galilee, Port of Providence, and the New Bedford Marine Commerce Terminal. The Proposed Action and other reasonably foreseeable wind energy projects may use the port facilities shown in Figure 3.14.1. While the extent of port facilities and upgrades are unknown at this time, land use impacts could occur at these 10 port facilities and surrounding areas, which is why they are included in the land use and coastal infrastructure GAA.

The GAA also includes the 18 BOEM OCS Lease Areas that range from the offshore Norfolk, Virginia, area in the south to the offshore Rhode Island area in the north (see Figure 3.14-1). Appendix E contains detailed descriptions of these port facilities and Lease Areas. These areas encompass locations where BOEM anticipates direct and indirect impacts associated with proposed onshore facilities and ports.

Affected environment: The Town of North Kingstown, one of 10 towns in Washington County, is located south of Providence, Rhode Island, and is bordered on the south by the towns of South Kingstown and Narragansett, on the north by East Greenwich, on the west by Exeter, and on the east by Narragansett Bay. North Kingstown is the second-largest Washington County town, with a population of 26,323 in 2019 (U.S. Census Bureau 2019). It is part of the Providence metropolitan area, with a land area of approximately 58 square miles.

North Kingstown is a primarily residential community characterized by a mixture of farms, natural areas, cultural centers, villages, historic districts and towns, and countryside (Interface Studio 2019). There are several unique points of interest in the town, including the Davis Memorial Wildlife Refuge, Smith's Castle, and Quonset Point, among others. Land use within the Town of North Kingstown largely comprises small areas of low-density residential enclaves surrounded by forests, brushland, and pastures. North Kingstown also contains areas with mines, quarries, and gravel pits, as well as industrial and commercial hubs. The waterfront areas of North Kingstown include transportation facilities such as the Port of Davisville at Quonset Point, open space, high-density residential, wetlands, and other uses.

The proposed RWEC landing site would be within the landfall envelope described in the COP (see COP Figure 2.2.1-3), which totals approximately 20 acres, located at the Port of Davisville at Quonset Point in North Kingstown (see COP Figure 1.1-1). The landfall envelope is generally bounded by Whitecap Drive on the west, the Electric Boat property on the east, and Circuit Drive on the north. Within the landfall envelope is a landfall work area measuring up to 3.1 acres. The landfall work area is part of The Port of Davisville at Quonset Point, which is the location of the former Naval Air Station Quonset Point. The landfall work area consists of several onshore elements:

- Up to two underground transmission circuits (called the onshore transmission cable), co-located within a single corridor
- An OnSS and ICF located adjacent to the existing Davisville Substation

- An underground ROW connecting the OnSS to the ICF (Interconnection ROW)
- An overhead ROW connecting the ICF to the Davisville Substation (TNEC ROW)

Land uses in the landfall envelope are primarily commercial and industrial. This area of the Port of Davisville at Quonset Point is part of the Quonset Business Park and contains several large businesses, including boat and pool manufacturers, medical laboratories, distribution centers, lumber distributors, and office space, among others (SO Rhode 2014). The landfall envelope area contains a few manufacturing and industrial buildings, associated parking lots, and access roads. Blue Beach, a public beach, is approximately 500 feet west of the southwest corner of the landfall envelope. Blue Beach is accessed via a trail located to the west of the Hayward Industries, Inc., building, which is just outside the landfall envelope. Compass Rose Beach, another public beach, is approximately 2,600 feet east of the southeast corner of the landfall envelope. The Martha's Vineyard Fast Ferry dock is located directly east of Compass Rose Beach. The eastern edge of the Quonset State Airport is also approximately 2,600 feet east of the landfall envelope. The North Kingstown Golf Course is approximately 2,000 feet north of the northern edge of the landfall envelope and is separated from the landfall envelope by Roger Williams Way.

Regardless of the landfall site selected, The preferred onshore transmission cable route is an approximate 1-mile (1.6-km) route that will predominantly follow along paved roads or previously disturbed areas such as parking lots. There are alternative onshore transmission cable routes under consideration within the onshore transmission cable envelope, as depicted on Figure 4.3.1-2 in the COP. Some of the routes under consideration have segments that would be installed in undeveloped, vegetated areas within parcels 179-003 and 179-005 (the Davisville Substation parcel), although most would be installed within paved roads and parking lots, as with the preferred onshore transmission cable route, and would be approximately the same length. Regardless of the exact route chosen, impact determinations would not be affected for any IPF (COP Figure 4.3.1-2). Land uses around the onshore Project footprint consist of low-density residential, commercial, public lands on the south side of Camp Avenue, and other commercial and industrial uses. There are two public beaches in the Project vicinity, Blue Beach and Compass Rose Beach, as well as three small schools. Based on the Town of North Kingstown's Assessors' Data (Interface Studio 2019), the segment of the RWEC from the mean high water level to the transition joint bays (TJBs), landfall work area, and onshore transmission cable are located within an area that is predominantly industrial but also consists of some large business commercial, low-medium residential (including single-family residences and duplexes), and undeveloped land uses. The property hosting the OnSS and ICF is surrounded by low-medium residential, medium-high-density residential, utility (i.e., the existing Davisville Substation), and undeveloped land uses. The OnSS will be located on two adjacent parcels (179-030 and 179-001) totaling 15.7 acres, both owned by the Rhode Island Commerce Corporation. The ICF will be located on an adjacent 6.1-acre parcel (179-005) owned by TNEC. COP Figure 4.6.7-1 (vhb 2022) depicts land uses in the vicinity of the onshore components of the Project.

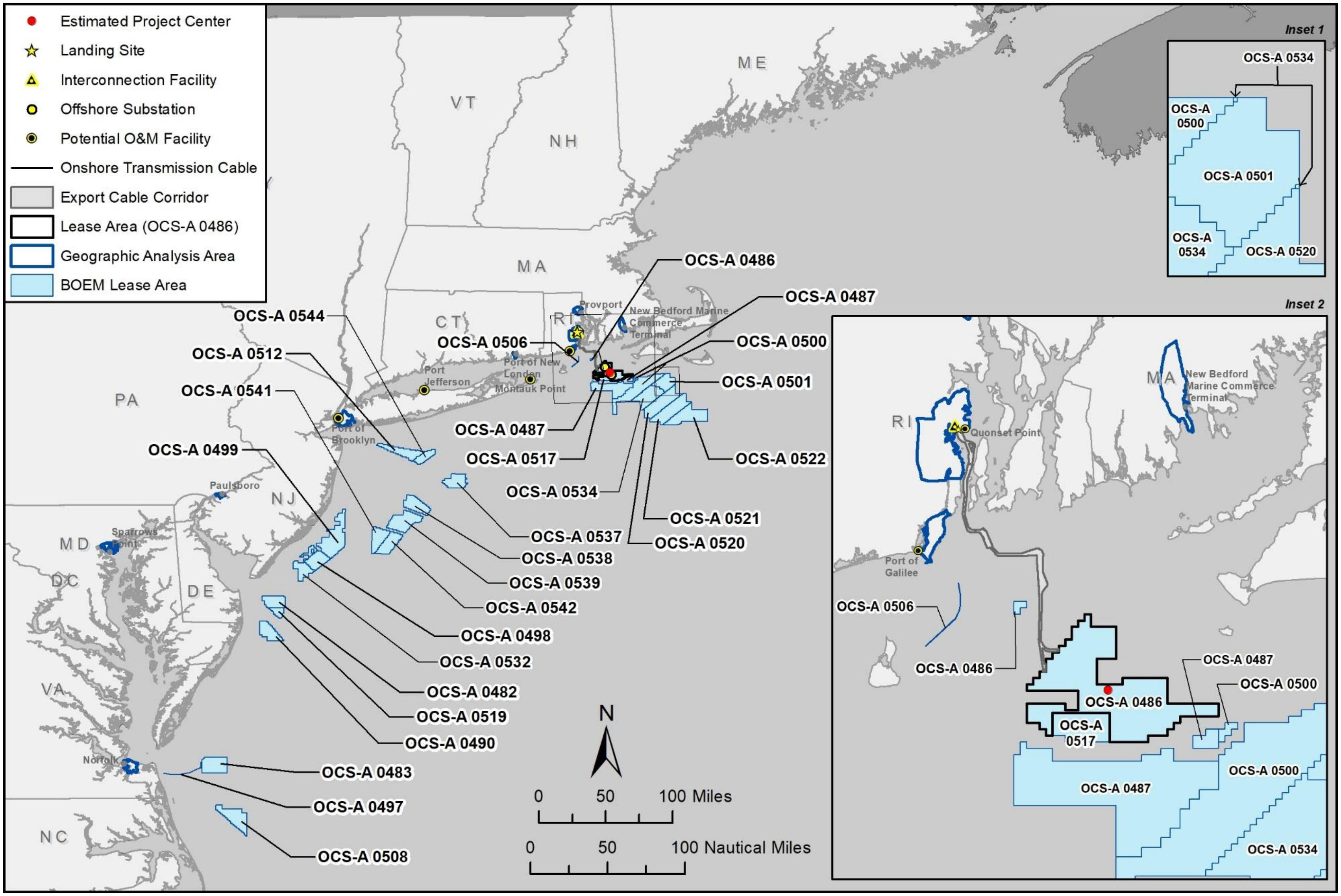

Figure 3.14-1. Geographic analysis area for land use and coastal infrastructure.

An OnSS and ICF would be constructed to support interconnection to the existing Davisville Substation, which is located within the Quonset Business Park in North Kingstown. The Davisville Substation operates at 115 kV and connects to the regional transmission grid via two 115-kV transmission tap lines. The existing substation is within North Kingstown Assessor's Plat 179 Lot 005. The OnSS location is on the north side of Camp Avenue in an area that is undeveloped. The Town of North Kingstown has designated the undeveloped area as a planned village development that is surrounded by the Quonset Business Park District (Town of North Kingstown, Rhode Island 2021a). The RWEC would enter the landfall work area underground, pass through the transition joint bays, and continue underground as the Onshore Transmission Cable to the OnSS. The connection cables running from the OnSS to the ICF would be underground. The cables connecting from the ICF to the existing Davisville Substation would be the only aboveground and overhead cables (vhb 2022).

Port of Davisville at Quonset Point, a port located in North Kingstown, is a former naval air station that was subsequently redeveloped into a modern industrial park (Interface Studio 2019). The industrial park, known as Quonset Point/Davisville Business Park, is on a peninsula in Narragansett Bay. The port is a multimodal transportation area with deepwater piers used for both shipping and ship repairs, an airport with the longest runway in the state, freight and passenger rail facilities, and interstate highway connections. The availability of a variety of industrially zoned land with full-service networks provides opportunities for new industries (Maguire Group, Inc. 2008). The Port of Davisville at Quonset Point is served by Rhode Island Route 403 and a railroad spur from Amtrak's Northeast Corridor, along with freight service provided by the Providence and Worcester Railroad. It is also the home of the Port of Davisville at Quonset Point, a golf course, four public beaches, ferry service to Martha's Vineyard, and two museums.

Other port facilities in New York, Rhode Island, Connecticut, Virginia, Massachusetts, Maryland, and New Jersey could also support construction of the RWF and offshore components of the RWEC (see COP Table 3.3.10-1). These ports are generally industrial in character and are typically adjacent to other industrial or commercial land uses and major transportation corridors. Before construction begins, Revolution Wind would finalize mobilization plans and arrangements at port facilities to support Proposed Action activities, including logistic support for fabrication, as needed (vhb 2022). See Section 3.9, Section 3.11, and Section 3.18 for discussions of recreational vessel and commercial fishing activity in these ports.

3.14.1.1 Future Offshore Wind Activities (without Proposed Action)

This section discloses potential land use and coastal infrastructure impacts associated with future offshore wind development. Analysis of impacts associated with ongoing activities and future non–offshore wind activities is provided in Appendix E2.

<u>Accidental releases and discharges:</u> Future offshore and onshore activities could result in accidental releases of trash or water quality contaminants (see Section 3.21 for quantities and details). Trash and contaminant spills would be minimized by vessel compliance with USCG regulations. In the event of a spill, adjacent properties and coastal infrastructure could be temporarily restricted. The exact extent of restrictions and other impacts would depend on the locations of landfall, substations, and cable routes, as well as the ports used to support future offshore wind energy projects. These impacts, however, would

generally be localized and short term. On this basis, the effects of accidental releases and discharges on land use under the No Action Alternative would be long term and **minor** adverse.

New cable emplacement/maintenance: Future offshore activities could result in onshore land disturbances to accommodate supporting cable infrastructure for offshore wind development. Land disturbance impacts would largely be limited to the construction and installation phase of any such projects and would be localized in nature.

Onshore, neighboring or adjacent land to cable placement could temporarily be disturbed by future offshore wind project–related noise, vibration, and dust, as well as travel delays along impacted roads. The simultaneous construction and installation of two or more onshore development projects and/or landing sites and onshore cable routes would generate cumulative short-term impacts to land use. State and local agencies would be responsible for managing actions to help minimize and avoid noise, air quality, and other impacts on nearby neighborhoods during construction and installation. All construction and operational impacts from land disturbance would be regulated through local land use and zoning regulations and would therefore comply with applicable laws. On this basis, the effects of land disturbance on land use under the No Action Alternative would be short term and **negligible** adverse**.**

Light: Future offshore activities could result in onshore lighting associated with supporting infrastructure for offshore wind development. These lighting sources would be minor adverse and short term in nature. All construction and operational impacts from land disturbance would be regulated through local land use and zoning regulations and would therefore comply with applicable laws. On this basis, the effects of light on land use under the No Action Alternative would be long term and **minor** adverse**.**

Permanent aviation warning lighting on any offshore wind WTGs proposed as part of future offshore wind activities would be visible from south-facing beaches and coastlines. Visibility would depend on distance from shore, topography, and atmospheric conditions but would be long term. If this lighting alters visitor behavior, land use in the form of tourism, recreation, and property values could subsequently be impacted. Lighting from substations could also affect the adjacent property use and residential development. However, new substations constructed as part of future offshore wind activities would likely be constructed near existing energy infrastructure or where land development regulations, such as zoning and land use plan designations, allow such uses. Therefore, land use would not be expected to be measurably changed, nor would light itself impact land uses or alter land use patterns. On this basis, the effects of light on land use under the No Action Alternative would be long term and **minor** adverse**.**

Noise: Future offshore activities could result in onshore noise associated with clearing and grading, construction and installation of aboveground and underground utility infrastructure and impervious surfaces, and other disturbances. These noise sources would be **minor** adverse and short term in nature.

Future offshore wind activities could result in increased noise during the construction and installation phases. Given the location of these projects within the RI/MA WEA (see Figure 1.1-2), there would be no noise impacts on land use from construction and installation, O&M, and decommissioning of the offshore components of future offshore wind activities. Future offshore wind activities could result in onshore noise impacts during construction and installation, O&M, and decommissioning of onshore elements of future offshore wind activities due to increased construction, traffic, dust, vibration, and other impacts. These noise impacts would be subject to state and local noise regulations and ordinances and therefore would have limited adverse impacts on land use due to the impacts occurring under regulatory thresholds.

On this basis, the effects of noise on land use under the No Action Alternative would be long term and **negligible** adverse.

3.14.1.2 Conclusions

Under the No Action Alternative, BOEM would not approve the COP; Project construction and installation, O&M, and decommissioning would not occur; and potential impacts on land use and coastal infrastructure associated with the Project would not occur. However, ongoing and future offshore wind activities would have continuing temporary to long-term impacts on land use and coastal infrastructure, primarily through onshore construction and installation and port activities.

BOEM anticipates that impacts for reasonably foreseeable offshore wind activities would be **minor** adverse. Impacts for ongoing activities and reasonably foreseeable activities other than offshore wind would be **minor** adverse, as discussed in Appendix E, Table E2-13. Accidental releases, electromagnetic fields (EMF), land disturbance, light, noise, and port utilization could have temporary adverse impacts on local land uses, but as a whole, ongoing use and development would support the region's diverse mix of land uses and provide support for continued maintenance and improvement of coastal infrastructure.

Considering all the IPFs together, BOEM anticipates that the impacts associated with future offshore wind activities in the GAA, combined with ongoing activities, reasonably foreseeable environmental trends, and reasonably foreseeable activities other than offshore wind, would result in **minor** adverse impacts because the overall effect would be localized and short term.

3.14.2 Environmental Consequences

3.14.2.1 Relevant Design Parameters, Impact-Producing Factors, and Potential Variances in Impacts

The analysis presented in this section considers the impacts resulting from the maximum design scenario under the project design envelope (PDE) approach developed by BOEM to support offshore wind project development (Rowe et al. 2017). The maximum design size specifications defined in Appendix D, Table D-1, are PDE parameters used to conduct this analysis. Several project parameters could change during the development of the final project configuration, potentially reducing the extent and/or intensity of impacts resulting from the associated IPFs.

The following design parameters would result in reduced impacts relative to those generated by the design elements considered under the PDE:

- The use of a casing pipe method to construct the RWEC sea-to-shore transition would eliminate the need for a temporary cofferdam, resulting in less extensive acoustic and vibration impacts than vibratory pile driving to construct a cofferdam thus reducing onshore noise and vibration impacts to coastal land uses (Zeddies 2021).
- The selection of an 8-MW WTG design would reduce the total WTG height from 873 to 648 feet, reducing the visual impact of the facility on coastal land uses.
- The selection of an alternate route for the onshore component of the RWEC could alter the location and increase or decrease the extent of construction-related ground disturbance, but the nature and overall significance of these impacts on land use would remain unchanged.

See Appendix E2 for a summary of IPFs analyzed for land use and coastal resources across all action alternatives. IPFs that are either not applicable to the resource or determined by BOEM to have a negligible adverse effect are excluded from Chapter 3 and provided in Appendix E1, Table E2-13. Offshore and onshore IPFs are addressed separately in the analysis if appropriate for the resource; not all IPFs have both an offshore and onshore component. Where feasible, calculations for specific alternative impacts are provided in Appendix E4, to facilitate reader comparison across alternatives.

Table 3.14-1 provides a summary of IPF findings carried forward for analysis. Each alternative analysis discussion consists of the construction and installation phase, the O&M phase, the decommissioning phase, and the cumulative analysis. If these analyses are not substantially different, then they are presented as one discussion. This comparison considers the implementation of all EPMs proposed by Revolution Wind to avoid and minimize adverse impacts on land use. These EPMs are summarized in Appendix F, Table F-1.

A detailed analysis of the Proposed Action is provided following the table. Detailed analysis of other considered action alternatives is also provided below the table if analysis indicates that the alternative(s) would result in substantially different impacts than the Proposed Action. Offshore and onshore IPFs are addressed separately in the analysis if appropriate for the resource; not all IPFs have both an offshore and onshore component.

The Conclusion section within each alternative analysis discussion includes rationale for the effects determinations. Overall, impacts to land use and coastal infrastructure from any action alternative would be **minor** adverse because they would be small, and the resource would be expected to recover completely with no mitigating action required.

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Table 3.14-1. Alternative Comparison Summary for Land Use and Coastal Infrastructure

Impact-Producing Factor	No Action Alternative	Alternative B (Proposed Action) Up to 100 WTGs	Alternative C (Habitat Alternative) 64 or 65 WTGs	Alternative D (Transit Alternative) 78 to 93 WTGs	Alternative E (Viewshed Alternative) 64 or 81 WTGs	Alternative F (Higher Capacity Turbine Alternative) 56 WTGs
Accidental releases and discharges	**Offshore**: Future offshore activities could result in accidental releases of trash or water quality contaminants (see Section 3.21 for quantities and details). These impacts, however, would generally be localized and short term. On this basis, the effects of accidental releases and discharges on land use under the No Action Alternative would be long term and **minor** adverse.	**Offshore**: Accidental releases and discharges of fuels, lubricants, and hydraulic fluids could occur during the construction and installation phase. Accidental releases would be minimized by containment and cleanup measures detailed in the Emergency Response Plan/OSRP. Therefore, there would be a **negligible** adverse impact from accidental releases and discharges on land use and coastal infrastructure. The Proposed Action and other reasonably foreseeable projects would be expected to comply with any applicable permit requirements to implement erosion, stormwater, and spill controls to minimize, reduce, or avoid impacts on water and air quality. As a result, the Proposed Action when combined with past, present, and other reasonably foreseeable projects would result in **negligible** adverse cumulative impacts on land use and coastal infrastructure because there would be no impact on land use and coastal infrastructure.	**Offshore**: Alternative C to F would require fewer vessel trips relative to the Proposed Action, reducing the risk of accidental releases and discharges from vessels. However, given the likelihood of such releases is low, the difference in level of risk would likely be undetectable. Likewise, risk of accidental releases and discharges could be slightly reduced from the reduced risk of vessel collisions/allisions. Because accidental releases and discharges in the offshore environment of the scale anticipated are not expected to measurably impact land use and coastal infrastructure, these impacts would similarly be **negligible** adverse.			
	Onshore: Future onshore activities could result in accidental releases of trash or water quality contaminants (see Section 3.21 for quantities and details). These impacts, however, would generally be localized and short term. On this basis, the effects of accidental releases and discharges on land use under the No Action Alternative would be long term and **minor** adverse.	**Onshore**: While accidental releases and discharges could impact land use and coastal infrastructure by introducing air or water quality contamination into areas undergoing construction and installation, O&M and decommissioning, it is anticipated that containment would prevent or mitigate discharges before they can impact land uses. Therefore, there would be a temporary, **negligible** adverse impact due to accidental releases and discharges on land use and coastal infrastructure.	**Onshore**: Alternatives C through F would consist of the same onshore facilities and activities as those planned under the Proposed Action. Therefore, onshore impacts to land use and coastal infrastructure from accidental releases and discharges would be effectively the same as those described for the Proposed Action: **negligible** adverse.			
Light	**Offshore**: Permanent aviation warning lighting on any offshore wind WTGs proposed as part of future offshore wind activities would be visible from south-facing beaches and coastlines. However, land use would not be expected to be measurably changed, nor would light itself impact land uses or alter land use patterns. On this basis, the effects of light on land use under the No Action Alternative would be long term and **minor** adverse.	**Offshore**: There would be a temporary increase in the amount of lighting during construction and installation due to the presence of work vessels. Given that offshore elements of the Proposed Action would be located approximately 12 to 15 miles from shore, it is anticipated that there would be very little lighting impact on land use and coastal infrastructure from construction and installation of offshore elements of the Proposed Action. Therefore, there would be a temporary, **negligible** adverse light impact on land use and coastal infrastructure. During operations, offshore structures would require lighting that conforms to FAA and BOEM guidelines, and USCG requirements. The visibility of WTGs and potentially the OSSs would result in a small impact to onshore land uses and coastal infrastructure by increasing light in the offshore environment that could be visible onshore and could slightly increase visible light in coastal communities. Decommissioning impacts would be similar to impacts from the Proposed Action construction and installation. Therefore, there would be a long-term, **minor** adverse light impact on land use and coastal infrastructure from O&M and decommissioning of offshore elements of the Proposed Action. The Proposed Action and other reasonably foreseeable projects would be expected to comply with applicable permit conditions and lighting requirements to minimize, reduce, or avoid light impacts on onshore land uses and coastal infrastructure. Therefore, the cumulative impact would be **negligible** adverse.	**Offshore**: While Alternatives C through F could result in a slight reduction in construction lighting, the effects of this IPF on land use and coastal infrastructure under the Habitat Alternative would otherwise be similar to those described for the Proposed Action, ranging from **negligible** adverse to **minor** adverse.			

Impact-Producing Factor	No Action Alternative	Alternative B (Proposed Action) Up to 100 WTGs	Alternative C (Habitat Alternative) 64 or 65 WTGs	Alternative D (Transit Alternative) 78 to 93 WTGs	Alternative E (Viewshed Alternative) 64 or 81 WTGs	Alternative F (Higher Capacity Turbine Alternative) 56 WTGs
	Onshore: Future offshore activities could result in onshore lighting associated with supporting infrastructure for offshore wind development. These lighting sources would be minor adverse and short term in nature. On this basis, the effects of light on land use under the No Action Alternative would be long term and **minor** adverse**.**	**Onshore**: Nighttime lighting could have a temporary adverse impact on land use and coastal infrastructure by increasing artificial lighting that could be visible by residences and businesses nearby. Operational lighting onshore would be limited to the OnSS and ICF. In general, lighting would be minimal and directed downward. Lighting would be removed as part of decommissioning. Therefore, there would be a long-term, **minor** adverse light impact on land use and coastal infrastructure from construction, O&M, and decommissioning of onshore elements of the Proposed Action. Temporary and permanent lighting would require compliance with local development regulations at the port facilities and locations where reasonably foreseeable future projects would experience onshore lighting impacts. Therefore, cumulative impacts associated with the Project when combined with past, present, and reasonably foreseeable future activities would be **minor** adverse on land use and coastal infrastructure.	**Onshore:** Alternatives C through F would consist of the same onshore facilities and activities as those planned under the Proposed Action. Therefore, onshore impacts to land use and coastal infrastructure from lighting would be effectively the same as those described for the Proposed Action: **minor** adverse.			
New Cable Emplacement/Maintenance	**Onshore**: Future offshore activities could result in onshore land disturbances to accommodate supporting cable infrastructure for offshore wind development. Onshore, neighboring or adjacent land to cable placement could also temporarily be disturbed by future offshore wind project–related noise, vibration, and dust, as well as travel delays along impacted roads. All construction and operational impacts from land disturbance would be regulated through local land use and zoning regulations and would therefore comply with applicable laws. On this basis, the effects of land disturbance on land use under the No Action Alternative would be short term and **negligible** adverse.	**Onshore**: All Proposed Action-related construction and installation would take place within areas zoned for industrial and commercial development and would be subject to land use and zoning regulations that limit impacts. Therefore, there would be a short-term, **minor** adverse land disturbance impact on land use and coastal infrastructure. Once installed, the onshore components of the RWEC would be located underground and disturbed areas would be restored to preconstruction conditions or improved. Due to the temporary and intermittent nature of O&M activities, O&M of onshore facilities would have a **negligible** adverse impact on land use over the 35-year lifespan of the Project. The Project and other reasonably foreseeable future projects would be required to comply with local land use and zoning regulations, which would reduce impacts to land use and coastal infrastructure. Therefore, cumulative impacts associated with the Proposed Action when combined with past, present, and reasonably foreseeable future activities would be **minor** adverse on land use and coastal infrastructure.	**Onshore**: Alternatives C through F would consist of the same onshore facilities and activities as those planned under the Proposed Action. Therefore, onshore impacts to land use and coastal infrastructure from new cable emplacement/maintenance would be effectively the same as those described for the Proposed Action, ranging from **negligible** adverse to **minor** adverse.			

Impact-Producing Factor	No Action Alternative	Alternative B (Proposed Action) Up to 100 WTGs	Alternative C (Habitat Alternative) 64 or 65 WTGs	Alternative D (Transit Alternative) 78 to 93 WTGs	Alternative E (Viewshed Alternative) 64 or 81 WTGs	Alternative F (Higher Capacity Turbine Alternative) 56 WTGs
Noise	**Offshore**: Future offshore wind activities could result in increased noise during the construction and installation phases. These noise impacts would be subject to state and local noise regulations and ordinances. On this basis, the effects of noise on land use under the No Action Alternative would be long term and **negligible** adverse.	**Offshore**: While offshore noise associated with the Proposed Action construction could be audible onshore, it would be below ambient noise levels and therefore would have a minimal impact on land use and coastal infrastructure. Therefore, there would be a temporary, **negligible** adverse noise impact on land use and coastal infrastructure. There would be no noise impacts on land use and coastal infrastructure from O&M of offshore facilities. Therefore, the impact on land use and coastal infrastructure from O&M and decommissioning of offshore elements of the Proposed Action would be **negligible** adverse. Noise associated with the Project and reasonably foreseeable offshore wind activities are not expected to generate noise levels that would be audible onshore. Therefore, the cumulative impacts associated with the Proposed Action when combined with past, present, and reasonably foreseeable activities would be **negligible** adverse.	**Offshore**: Under Alternatives C through F, fewer monopiles would be constructed and installed. While Alternatives C through F could result in a slight reduction in construction noise, the effects of this IPF on land use and coastal infrastructure would otherwise be similar to those described for the Proposed Action. Therefore, the impact on land use and coastal infrastructure would be **negligible** adverse, which is the same impact determination as the Proposed Action.			
	Onshore: Future offshore activities could result in onshore noise associated with clearing and grading, construction and installation of aboveground and underground utility infrastructure and impervious surfaces, and other disturbances. These noise sources would be **minor** adverse and short term in nature.	**Onshore**: Noise and traffic would result from construction and installation of the onshore facilities. EPMs would minimize, but not eliminate, noise effects on surrounding land uses. However, these effects would be short term and generally consistent with noise impacts associated with general development under zoned land uses (vhb 2021b). Therefore, there would be short term, **minor** adverse noise impact on land use and coastal infrastructure from construction and installation of onshore elements of the Proposed Action. Noise generated by onshore facilities and O&M and decommissioning activities would be managed under existing local ordinances and regulations as permitted for the approved zoning. As such, noise impacts on land use from the O&M and decommissioning of onshore facilities would have a **negligible** adverse effect on land use. It is expected that noise impacts generated by other planned and foreseeable future actions would similarly be consistent with local ordinances applicable to zoned land uses. Therefore, cumulative impacts associated with the Project when combined with past, present, and reasonably foreseeable future activities would have a **negligible** adverse effect on land use and coastal infrastructure.	**Onshore**: Alternatives C through F would consist of the same onshore facilities and activities as those planned under the Proposed Action. Therefore, onshore impacts to land use and coastal infrastructure from noise would be effectively the same as those described for the Proposed Action, ranging from **negligible** adverse to **minor** adverse.			

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3.14.2.2 Alternative B: Impacts of the Proposed Action on Land Use and Coastal Infrastructure

3.14.2.2.1 Construction and Installation

Offshore Activities and Facilities

Accidental releases and discharges: Accidental releases and discharges of fuels, lubricants, and hydraulic fluids could occur during the construction and installation phase. These impacts are covered in Section 3.21. A draft OSRP has been prepared for the Project and consists of processes for rapid spill response, containment, cleanup, and other measures that would help minimize impacts on water quality from spills. A release during construction and installation of the Proposed Action would generally be localized, short term, and **minor** adverse, resulting in little change to water quality.

Offshore accidental releases and discharges during construction and installation would not result in land use and coastal infrastructure impacts, as incorporation of water quality EPMs described in Appendix F would aid in reducing the chances of accidental releases and discharges; accidental releases and discharges would be contained and mitigated according to federal, state, and local law. Applicable EPMs in Appendix F include compliance with regulatory requirements related to the prevention and control of spills and discharges, implementation of an OSRP to manage accidental spills or releases of oils or other hazardous materials, and compliance with USCG and EPA regulations. Therefore, potential offshore accidental releases and discharges would be unlikely to result in onshore land use and coastal infrastructure impacts, as these impacts would be mitigated prior to any impacts affecting onshore resources. Therefore, there would be a **negligible** adverse impact from accidental releases and discharges on land use and coastal infrastructure during construction and installation of offshore elements of the Proposed Action, as there would be no effect from offshore accidental releases and discharges on land use and coastal infrastructure.

Light: There would be a temporary increase in the amount of lighting during construction and installation due to the presence of work vessels. In general, lights would be required on offshore platforms and structures, vessels, and construction equipment during construction and installation of the RWF. In addition, temporary work lighting would illuminate work areas on vessel decks or service platforms of adjacent WTGs or OSS platforms during nighttime construction. Project construction lighting would meet USGS requirements, when required by federal regulations.

The RWEC would also require USCG-approved navigation lighting for all vessels during construction and installation of the RWEC. All vessels operating between dusk and dawn would be required to turn on navigation lights. Cable laying could occur 24 hours a day during certain periods, and these vessels would be illuminated at night for safe operations. Given that offshore elements of the Project would be located approximately 12 to 15 miles from shore, it is anticipated that there would be very little lighting impact on land use and coastal infrastructure from construction and installation of offshore elements of the Project. Therefore, there would be a temporary, **negligible** adverse light impact on land use and coastal infrastructure from construction and installation of offshore elements of the Proposed Action.

Noise: Construction and installation of offshore elements of the Project would result in increased noise. The proposed Project would be approximately 15 miles west of the Town of New Shoreham, Rhode Island, (Block Island) and 15 to 20 miles south of several other coastal towns in Rhode Island including South Kingstown, Narragansett, Jamestown, Newport, Middletown, and Little Compton. The Project would be approximately 12 miles east/southeast of Martha's Vineyard, Massachusetts, and 13 to 16 miles south of other coastal towns in Massachusetts such as Westport, Dartmouth, and Gosnold. The maximum pile-driving noise from construction and installation of offshore Project elements audible from coastal towns would be 11.2 dBA, which is below ambient noise levels at towns in the vicinity, which range from 25 to 45 dBA during the night and 35 to 55 dBA during the day (vhb 2020). While offshore noise associated with the Proposed Action could be audible onshore, it would be below ambient noise levels and therefore would have a minimal impact on land use and coastal infrastructure. Therefore, there would be a temporary, **negligible** adverse noise impact on land use and coastal infrastructure from construction and installation of offshore elements of the Proposed Action.

Onshore Activities and Facilities

Accidental releases and discharges: Installation of the RWEC at the landfall location would use an HDD approach to install the cables under the beach and intertidal water areas. The use of drilling fluid, which typically consists of a water and bentonite mud mixture or another non-toxic drilling fluid, would be required. Bentonite is a natural clay that is mined from the earth. While these fluids are considered non-toxic, Revolution Wind would implement applicable EPMs listed in Appendix F during construction to minimize potential releases of the drilling fluid associated with HDD activities.

Solid wastes and construction debris would be generated predominately during construction and installation of onshore facilities. Per requirements outlined in 30 CFR 585.626, maximum quantities of and disposal methods for liquids and solid wastes, including hazardous materials, are summarized in COP Section 3.3.9.4 for construction. COP Table 3.3.1-2 also outlines maximum quantities of disposal methods for liquids and solid wastes, including hazardous materials for the OnSS. A spill prevention control and countermeasures plan would be developed in support of NPDES compliance and the potential for discharges and releases from onshore construction and installation would be governed by Rhode Island regulations and the Project's COP. It is anticipated that construction and installation of the OnSS would generate approximately 3,000 cy of solid waste that would be disposed of in a landfill and/or recycling center (vhb 2022).

In accordance with applicable federal, state, and local laws, comprehensive measures would be implemented prior to and during construction and installation activities to avoid, minimize, and mitigate impacts related to trash and debris disposal. Construction and installation of onshore elements could result in accidental releases and discharges of solid wastes and construction debris that could impact land use; however, the Project would implement applicable EPMs (see Appendix F) and comply with federal, state, and local regulations to reduce the impacts to land use and coastal infrastructure. Some of the EPMs listed in Appendix F include containing drilling fluids for later reuse, creating an HDD contingency plan and SESC plan, and compliance with the RIPDES General Permit for Stormwater Discharges associated with Construction Activities.

While accidental releases and discharges could impact land use and coastal infrastructure by introducing air or water quality contamination into areas undergoing construction and installation, it is anticipated that containment measures outlined above would prevent or mitigate discharges before they can impact land uses. Therefore, there would be a temporary, **negligible** adverse impact due to accidental releases and discharges on land use and coastal infrastructure from construction and installation of onshore elements of the Proposed Action.

New cable emplacement/maintenance: Airborne noise, vibration and dust, and increased vehicle traffic associated with construction and installation of the RWEC landing site and onshore export cable components would temporarily disturb neighboring land uses along the RWEC route. Portions of the development footprint could also be fenced and inaccessible at various points during construction and installation. Construction and installation activities causing these impacts consist of HDD for the RWEC, preparation and installation of TJBs that connect the RWEC and onshore transmission cable, and installation of the onshore transmission cable.

The onshore transmission cable would be installed within an underground duct bank between the TJBs and the OnSS and would be installed within or along previously disturbed areas including the shoulders of existing public roadways, lands owned by Quonset Development Corporation, and private properties. The onshore transmission cable would result in 3.1 acres (1.3 hectares) of land disturbance but would be located outside wetlands and other waterbodies. The landfall work area would require clearing, grading, and hardening to support the installation of the TJBs and would temporarily result in up to 3.1 acres (1.3 ha) of land disturbance. The TJBs would be excavated and installed underground within the landfall work area and access inside the TJBs would be provided by manholes. Therefore, land disturbance associated with the TJB area would be temporary. As discussed above, the onshore transmission cable, landfall work area, and TJBs would result in temporary impacts only. In addition, work would be sited in uplands and all activities would be conducted in compliance with the RIPDES General Permit for the Discharge of Stormwater Associated with Construction Activities and an approved SESC plan. Therefore, with the implementation of the EPMs outlined in Appendix F, land disturbance activities during construction and installation of the onshore transmission cable are expected to result in direct and short-term water quality impacts (vhb 2022).

Construction and installation of the Project's onshore components would require construction staging in parking lots adjacent to or near the landing site. While most of the construction staging would occur on private property, construction could reduce public parking available at the Blue Beach parking lot during construction and installation. These disturbances would be short term, with construction expected to begin in Quarter 1 of 2023 and last approximately 8 months (see COP Section 3.2). Construction along public roadways would be completed in a matter of days or weeks. At the landing site, the Project would make the physical connection between the offshore RWEC and the onshore RWEC in two underground TJBs. The only long-term, visible components of the cable system would be the manhole covers (vhb 2021a).

Onshore construction and installation would include trench excavation and placement of the onshore RWEC within existing paved roads. Revolution Wind would abide by local construction ordinances. Construction and installation would occur primarily during normal daylight hours except for certain activities associated with cable installation at the chosen landing site (vhb 2021a) that could require nighttime activity to meet rapid construction timelines and to reduce the chances of equipment failure. Revolution Wind would work with the Town of North Kingstown to develop a detailed plan that includes traffic and other control measures prior to beginning major construction. The traffic plan with North Kingstown would identify appropriate alternative routes that would accommodate projected traffic loading during construction and installation activities. BOEM assumes that the Project would avoid permanent disruption to existing underground utilities, such as water, sewer, and electrical lines. However, depending on the exact placement of the onshore RWEC cable, the physical size and location of the cable could hamper future installation of public utilities such as water, sewer, and stormwater lines, which are typically placed beneath roadway travel lanes. Vehicular and construction equipment emissions would be similar to those described for offshore development. The potential impacts from construction and diesel-generating equipment would be reduced through EPMs related to fuel-efficient engines and dust control plans, as outlined in Section 3.4.1.

All Project-related construction and installation would take place within areas zoned for industrial and commercial development and would be subject to land use and zoning regulations that limit impacts. Therefore, there would be a short-term, **minor** adverse land disturbance impact on land use and coastal infrastructure from construction and installation of onshore elements of the Proposed Action.

<u>Light:</u> Most onshore construction and installation would be completed during daytime hours. Typical construction work hours for the Project would be 7:00 a.m. to 6:00 p.m. Monday through Friday when daylight permits and 7:00 a.m. to 5:00 p.m. on Saturdays. This is consistent with the Town of North Kingstown noise ordinance (Town Code Article VI). However, some work tasks, such as concrete pours, landfall installation, and cable pulling or splicing, once started, require completion without interruption and could go beyond normal work hours. In addition, the nature of transmission line construction and installation requires line outages for certain procedures such as transmission line connections, equipment cutovers, or stringing under or over other transmission lines. These outages are dictated by ISO New England and can be very limited based on regional system load and weather conditions. Work requiring scheduled outages and crossings of certain transportation and utility corridors may be required on a limited basis outside of normal work hours, including Sundays and holidays.

For nighttime construction and installation work, portable floodlights with a maximum height of approximately 18 feet would be used. All lights on portable lightstands would be downward facing. Any nighttime lighting used during construction and installation would comply with safety and security and local requirements.

Construction equipment, the OnSS, ICF, and structures within the TNEC ROW would be visible during construction and installation. Although construction is expected to take place primarily during the daylight hours between 7:00 a.m. and 6:00 p.m., some temporary lighting may be required outside those hours. Certain activities associated with cable installation at the chosen landing site (vhb 2022) could require nighttime activity and lighting to meet rapid construction timelines and to reduce the chances of equipment failure. Nighttime lighting could have a temporary adverse impact on land use and coastal infrastructure by increasing artificial lighting that could be visible by residences and businesses nearby. Therefore, there would be a temporary, **minor** adverse light impact on land use and coastal infrastructure from construction and installation of onshore elements of the Proposed Action.

<u>Noise:</u> Noise and traffic would result from construction and installation of the onshore facilities. As described within the Onshore Acoustic Assessment in COP Appendix P2, long-term ambient sound measurements conducted within the proposed layout of the onshore facilities ranged from 44 to 45 dBA (Leq) at night (10:00 p.m. to 7:00 a.m.) and 49 to 50 dBA during the day (7:00 a.m. to 10:00 p.m.) (vhb 2021b). Operation of construction equipment and construction-related traffic would increase the ambient noise between the typical construction hours of 7:00 a.m. and 6:00 p.m. during the approximately 1-year construction period. The onshore facilities construction noise sources would include equipment used to support the HDD operations at the landfall work area, equipment used to support trenching and cable pulling, and construction vehicles such as excavators, dump trucks, and paving equipment (vhb 2021b).

Temporary construction and facility installation noise would be consistent with noise sources typically associated with a working industrial park. Short-term construction noise impacts would be generated during HDD onshore for the RWEC. A cofferdam could be used to ensure a dry environment during construction and installation and to manage sediment and would align with HDD exit pits. If the cofferdam is required, the cofferdam could be installed as either a sheet piled structure into the seafloor or a gravity cell structure placed on the seafloor using ballast weight. If the cofferdam is installed using sheet pile, a vibratory hammer would be used to drive the sidewalls and endwalls into the seafloor. Installation of the sheet pile cofferdam could take approximately up to 14 days. Noise associated with possible sheet pile installation would produce the maximum amount of noise compared to other construction methods. In general, noise generated by RWEC construction and installation activities would occur during daytime hours (7:00 a.m. to 8:30 p.m.), and would be largely generated by an excavator, crane, and sheet pile driver. If the HDD methodology is selected for construction of the RWEC, HDD operations would occur continuously to minimize the risk of soil settlement and equipment failures and would create noise during nighttime hours (vhb 2021b). Noise generated by construction and installation activities is expected to comply with the Town of North Kingstown noise code. The closest residences to the construction and installation of the onshore transmission cable, ICF, and OnSS are the residences on the south side of Camp Avenue and east side of Mill Creek Drive, which are within a few hundred feet of the construction area. The Onshore Acoustic Assessment (vhb 2021b) analyzed onshore construction noise and found that sound levels around the onshore transmission cable, ICF, and OnSS would be between 40 and 45 dB at residences along the south side of Camp Avenue and east side of Mill Creek Drive, which would be below ambient levels, measured between 44 and 45 dBA (Leq) at night and 49 to 50 dBA during the day at the time of the analysis.

During construction and installation of the onshore elements of the RWEC, construction noise could approach or exceed the Town of North Kingstown's noise code limit for construction and installation activities at receptors immediately adjacent to the road ROW. EPMs for onshore construction and installation activities include coordination with local governments and compliance with appropriate local ordinances governing noise, light, and traffic impacts consistent with zoned land uses (see Appendix F). These EPMs would minimize, but not eliminate, noise effects on surrounding land uses. However, these effects would be short term and generally consistent with noise impacts associated with general development under zoned land uses. Therefore, there would be short term, **minor** adverse noise impact on land use and coastal infrastructure from construction and installation of onshore elements of the Proposed Action.

3.14.2.2.2 Operations and Maintenance and Decommissioning

Offshore Activities and Facilities

<u>Accidental releases and discharges:</u> The WTGs and OSSs would be designed to contain any potential leakage of fluids, thereby preventing the discharge fluids into the ocean. During WTG operations, small accidental leaks could occur because of broken hoses, pipes, or fasteners. During WTG maintenance, small releases could occur during servicing of hydraulic units or gearboxes. Any accidental leaks within the WTGs would be contained within the hub and main bed frame or tower. During operations, the only discharges to the sea that are anticipated are those associated with vessels performing maintenance. (see Appendix D of the COP) (vhb 2022). Decommissioning impacts would be similar to construction and installation impacts discussed above. Any offshore leakage of fluids would not impact land use and

coastal infrastructure due to the design feature of WTGs to capture accidental releases and discharges and because implementation of EPMs in Appendix F would minimize the potential for spills. Therefore, there would be a **negligible** adverse impact from accidental releases and discharges on land use and coastal infrastructure from O&M and decommissioning of offshore elements of the Proposed Action.

Light: During operations, offshore structures would require lighting that conforms to FAA and BOEM guidelines, and USCG requirements. BOEM has indicated that offshore lighting should meet standard specifications in FAA Advisory Circulars 70/7460-1L, Change 2 (FAA 2018), and 150/5345-43H (FAA 2016), and USCG standards for marine navigation lighting.

Lighting associated with the Proposed Action would follow lighting and marking design parameters as identified in BOEM's Draft Proposed Guidelines for Providing Information on Lighting and Marking of Structures Supporting Renewable Energy Development, released April 2021 (BOEM 2021). Control, lighting, marking, and safety systems would be installed on each WTG; the specific systems would vary depending on the turbine selected and would be reviewed as part of the federal approval process.

Offshore turbines must be visible not only to pilots in the air, but also mariners navigating on water. In daylight, offshore wind turbines do not require lighting if the tower and components are painted white. The FAA and USCG consider white-colored turbines to be the most effective early warning technique for both pilots and mariners (Patterson 2005). Marine navigation lighting is regulated by the USCG through 33 CFR 67. Structures must be fitted with lights for nighttime periods. The OSSs would be lit and marked in accordance with FAA and USGS requirements for aviation and navigation obstruction lighting, respectively. Lighting on the RWEC during the O&M phase would be short term and limited to the lighting required on vessels while operating along the corridor. As described above for RWF construction and installation, USCG-approved navigation lighting is required for all vessels operating between dusk and dawn.

While WTGs and the OSSs would be lit, only a relatively small portion of the onshore locations would have open views of the Project. A viewshed analysis of the Project determined that only 44.9 square miles of land within the 6,113 square mile Visual Study Area could have potential views of the Project from ground level (EDR 2021). The visibility of WTGs and potentially the OSSs would result in a small impact to onshore land uses and coastal infrastructure by increasing light in the offshore environment that could be visible onshore and could slightly increase visible light in coastal communities. Decommissioning impacts would be similar to impacts from Project construction and installation. Therefore, there would be a long-term, **minor** adverse light impact on land use and coastal infrastructure from O&M and decommissioning of offshore elements of the Proposed Action.

Noise: There would be no noise impacts on land use and coastal infrastructure from O&M of offshore facilities. Operational noise would not be audible onshore. Decommissioning impacts would be similar to impacts from Project construction and installation. Therefore, because there would be no effect, the impact on land use and coastal infrastructure from O&M and decommissioning of offshore elements of the Proposed Action would be **negligible** adverse.

Onshore Activities and Facilities

Accidental Releases and Discharges: The OnSS and ICF would require various oils, fuels, and lubricants to support its operations (see COP Table 3.3.1-2 and COP Table 3.3.1-3). Equipment would be mounted on concrete foundations with concrete secondary fluid containment designed for 110% containment and in accordance with industry and local utility standards. With EPMs, accidental release and discharge impacts to land use and coastal infrastructure from onshore O&M would be minimal. Decommissioning would incur similar impacts to those during the construction and installation phase. Therefore, there would be a temporary, **negligible** adverse impact from accidental releases and discharges on land use and coastal infrastructure from O&M and decommissioning of onshore elements of the Proposed Action due to implementation of containment measures and compliance with industry and utility standards.

<u>New cable emplacement/maintenance:</u> Once installed, the onshore components of the RWEC would be located underground and disturbed areas would be restored to preconstruction conditions or improved. Buried Project features would have no effect on adjacent land uses or coastal infrastructure. Revolution Wind has designed the Project to account for site-specific oceanographic and meteorological conditions within the analysis area, effectively avoiding the potential for beach erosion to expose the RWEC at the sea to shore transition zone.

Due to the temporary and intermittent nature of O&M activities, O&M of onshore facilities would have a **negligible** adverse impact on land use over the 35-year lifespan of the Project.

Impacts during decommissioning would be similar to the impacts during construction and installation. For onshore decommissioning, any removal of the underground, onshore cables (if not decommissioned in place) could result in temporary construction disturbances and delays along the affected roads and near the landing sites. The length and extent of these delays would be shorter in duration compared to those experienced during installation. However, all O&M activities would be consistent with local land use and zoning regulations and would be typical activities associated with industrial and commercial land uses. Therefore, there would be a temporary, **negligible** adverse land disturbance impact on land use and coastal infrastructure from decommissioning of onshore elements of the Proposed Action.

<u>Light:</u> Operational lighting onshore would be limited to the OnSS and ICF. Lighting at these facilities include 1) yard lighting and 2) task lighting. Both categories would be switched lights and would only be used during yard-based activity. The mounting heights for the lighting would range from 10 to 25 feet off the ground and the lights would be mounted on lamp posts, substation buildings, fire walls, or steel substation structures. The wattage for the individual lamps would range from 35 watts to 300 watts depending on the use. Operational lighting for the OnSS and ICF would comply with Quonset Development Corporation lighting regulations and are mounted with the lamp horizontal to the ground (light facing straight down) or with a lamp tilt no more than 25° from the horizon. The task lighting at both the OnSS and ICF would support emergency maintenance or repairs to the station equipment outside of normal business hours. The task lights would be mounted to direct light toward substation equipment to ensure adequate lighting for workers to perform emergency maintenance or repairs.

Considering the presence of an existing electrical substation and industrial uses of the area, new lighting associated with the OnSS and ICF could adversely affect residences directly adjacent to these facilities. These effects could be reduced through the use of EPMs such as visual screening. Lighting for the OnSS and ICF would be designed to the minimum standard necessary for substation safety and security per utility operational requirements, as well as state and local regulations. General yard lighting would be provided within the OnSS and ICF area for assessment of equipment. In general, yard lighting would be off at night unless lighting is necessary for in-progress site work or for safety and security.

In general, lighting would be minimal and directed downward. Lighting would be removed as part of decommissioning. Therefore, there would be a long-term, **minor** adverse light impact on land use and coastal infrastructure from O&M and decommissioning of onshore elements of the Proposed Action.

<u>Noise:</u> Operational noise of the underground cables is expected have no impacts to current land uses because there would be no permanent noise-generating equipment associated with the onshore transmission cable. The OnSS and ICF, as designed, would generate sound similar to or below existing ambient sound levels; therefore, operational noise levels would have a direct but small impact on land use and coastal infrastructure. The proposed OnSS would introduce new sources of sound including transformers, shun reactors, harmonic filters, and cooling and ventilation associated with the outdoor substation equipment, as well as condensers, pumps, skids, and auxiliary transformers associated with the synchronous condenser building. Sound from the substation would be 43.9 dBA or lower at the closest noise sensitive receptors, which would be below the EPA guideline for noise exposure (48.6 dBA Leq) and below the Town of North Kingston, Rhode Island, nighttime noise ordinance limit for residential properties (50 dBA). Operational sound from the OnSS would also be below 50 dBA at the nearest residential property lines and below 70 dBA at the nearest commercial/industrial property lines, which is below the noise ordinance noise limits (vhb 2021b). O&M vehicles and certain maintenance activities performed during O&M could also periodically generate noise audible to surrounding land uses throughout the life of the Project; generated noise would be similar to typical traffic noise and noise from general construction and installation activities. These continuous and intermittent impacts would be permanent. Noise generated by onshore facilities and O&M activities would be managed under existing local ordinances and regulations as permitted for the approved zoning. As such, noise impacts on land use from the O&M of onshore facilities would have a **negligible** adverse effect on land use. Decommissioning would generate noise similar to that during the construction and installation phase. Therefore, there would be a long-term **negligible** adverse noise impact on land use and coastal infrastructure from O&M and decommissioning of onshore elements of the Proposed Action.

3.14.2.2.3 Cumulative Impacts

Offshore Activities and Facilities

<u>Accidental releases and discharges:</u> The Proposed Action and other reasonably foreseeable future projects could result in accidental release of contaminants, trash, and debris that could add to releases from other reasonably foreseeable projects. The combined offshore accidental release impacts on land use and coastal infrastructure could increase the risk of and potential impacts from accidental releases in the GAA. The Proposed Action and other reasonably foreseeable projects would be expected to comply with any applicable permit requirements to implement erosion, stormwater, and spill controls to minimize, reduce, or avoid impacts on water and air quality. Land use and coastal infrastructure would be unlikely to be impacted by offshore accidental releases, as accidental releases would be mitigated offshore. As a result, the Proposed Action when combined with past, present, and other reasonably foreseeable projects would result in **negligible** adverse cumulative impacts on land use and coastal infrastructure because there would be no impact on land use and coastal infrastructure.

<u>Light:</u> The Proposed Action would add permanent lighting for up to 102 WTGs and two OSSs. Although this lighting would be visible, in part, from south-facing beaches and coastlines, this represents a small but noticeable (3%) increase over total estimated WTG and OSS foundations providing long-term lighting

under the No Action Alternative if all projected offshore wind projects are constructed. BOEM estimates a maximum cumulative total of 3,110 offshore WTGs and OSS foundations for the Proposed Action plus all other future offshore wind projects. The land use impacts from the Proposed Action in the context of reasonably foreseeable future actions would be more extensive than impacts for the Proposed Action alone. However, the Proposed Action and other reasonably foreseeable projects would be expected to comply with applicable permit conditions and lighting requirements to minimize, reduce, or avoid light impacts on onshore land uses and coastal infrastructure. Therefore, the cumulative impacts associated with the Proposed Action when combined with past, present, and reasonably foreseeable activities would be similar to those impacts described under the No Action Alternative and would be **negligible** adverse impacts.

Noise: There would be no noise impacts on land use and coastal infrastructure from offshore facilities. Noise associated with construction and installation, O&M, and decommissioning would not be audible onshore. Similarly, reasonably foreseeable activities are not expected to generate noise levels that would be audible onshore. Therefore, the cumulative impacts associated with the Proposed Action when combined with past, present, and reasonably foreseeable activities would be similar to those impacts described under the No Action Alternative, which are described as having no onshore impacts from offshore facilities and would be **negligible** adverse impacts.

Onshore Activities and Facilities

Accidental releases and discharges: Installation of the RWEC at the landfall location would use an HDD approach to install the cables under the beach and intertidal water areas. Discharge of drilling fluids, solid wastes, and construction debris is possible during construction and installation. Additionally, discharge of oils, fuels, and lubricants is possible at the OnSS and ICF during Project operations and during maintenance activities. The Project would implement EPMs (see Appendix F) and comply with federal, state, and local regulations to reduce the impact to land use and coastal infrastructure. Reasonably foreseeable future projects would also require the construction of onshore facilities at identified ports along the Atlantic coast. Installation of onshore elements of reasonably foreseeable future projects could also result in the discharge of drilling fluids, solid wastes, construction debris, lubricants, oils, fuels, and other hazardous materials during construction, installation, and decommissioning. In context of reasonably foreseeable future actions, the combined offshore accidental release impacts on land use and coastal infrastructure could increase the risk of and potential impacts from accidental releases in the GAA. Other reasonably foreseeable actions would also be required to implement EPMs and adhere to federal, state, and local regulations to ensure that accidental releases and discharges are minimized and mitigated appropriately. Therefore, cumulative impacts associated with the Proposed Action when combined with past, present, and reasonably foreseeable future activities would be **negligible** adverse on land use and coastal infrastructure.

New cable emplacement/maintenance: The Proposed Action would result in increased onshore land disturbance during the construction and installation phase of the Project. It would result in temporary increases in construction noise, vibration and dust, and intermittent delays in travel along impacted roads. O&M activities would include periodic inspections and repairs at cable access manholes, which would require minimal use of worker vehicles and construction equipment. Reasonably foreseeable projects are expected to also result in land disturbances consistent with the Proposed Action in terms of scale, intensity, and duration at the ports and other facilities across the Atlantic coast where these projects are expected to occur. Assuming that new substations for future offshore wind projects would be in locations designated for industrial or utility uses, and underground cable conduits would primarily be co-located with roads or other utilities, operation of substations and cable conduits would not affect the established and planned land uses for a local area. Additionally, the Project and other reasonably foreseeable future projects would be required to comply with local land use and zoning regulations, which would reduce impacts to land use and coastal infrastructure. Therefore, cumulative impacts associated with the Proposed Action when combined with past, present, and reasonably foreseeable future activities would be **minor** adverse on land use and coastal infrastructure.

Light: There would be temporary and permanent light impacts under the Proposed Action. Temporary lighting impacts would occur with Project construction, installation, and decommissioning. While most onshore construction and installation would be completed during daytime hours, some tasks could extend beyond daylight work hours and would require the use of portable floodlights that would face downward. There would also be long-term permanent light impacts associated with O&M. Operational lighting would be limited to the OnSS and ICF. All operational lighting would be required to comply with Quonset Development Corporation lighting regulations. Other reasonably foreseeable projects would also generate onshore lighting impacts similar in nature to the Proposed Action. While many of these lighting impacts would be short term and temporary during Project construction and installation, some lighting associated with onshore facilities would be permanent, resulting in long-term lighting impacts in the vicinity of the OnSS and ICF. Temporary and permanent onshore lighting impacts are expected during construction, installation, O&M, and decommissioning of reasonably foreseeable future projects, including any port upgrades at port facilities described in Appendix E. These impacts are expected to be similar in scale to the lighting impacts for the Proposed Action but distributed across port facilities along the Atlantic coast. Temporary and permanent lighting would require compliance with local development regulations at the port facilities and locations where reasonably foreseeable future projects would experience onshore lighting impacts. Therefore, cumulative impacts associated with the Proposed Action when combined with past, present, and reasonably foreseeable future activities would be **minor** adverse on land use and coastal infrastructure.

Noise: There would be noise impacts associated with the construction and installation of the Proposed Action. Construction and installation would be limited to daylight hours and noise impacts would consist of noise generated from heavy equipment used for clearing, grading, excavation, foundation installation, and heavy lifting of substation components. Noise modeling conducted for operations of the OnSS (vhb 2021b) indicates that predicted noise levels would be below the minimum disturbance thresholds specified by code (Article VI, Sec. 8-87[a]) (Town of North Kingstown, Rhode Island 2021b). No permanent noise-generating equipment would be associated with the onshore transmission cable, resulting in no impacts to current land uses from operational noise. The OnSS and ICF, as designed, would generate sound similar to or below existing ambient sound levels, as described in Section 3.14.2.2.2; therefore, operational noise levels would have a direct but small impact on land use and coastal infrastructure by increasing noise levels in the vicinity of onshore elements of the Proposed Action. Additionally, O&M and maintenance vehicles could result in increased noise in the vicinity when maintenance is being performed. However, all equipment and O&M activities would be designed for and consistent with zoned land uses and appropriate ordinance restrictions, as described in Section 3.14.2.2.2. It is expected that noise impacts generated by other planned and foreseeable future actions would be generally similar to those generated under the Proposed Action, and those actions would similarly manage impacts consistent with local ordinances applicable to zoned land uses. Therefore, cumulative impacts associated with the Proposed Action when combined with past, present, and reasonably foreseeable future activities would have a **negligible** adverse effect on land use and coastal infrastructure.

3.14.2.2.4 Conclusions

Proposed Action construction and installation and decommissioning would temporarily generate noise, vibration, and vehicular traffic. Impacts during O&M would be expected to be similar, but in lower duration and extent. Therefore, BOEM expects the overall impact on land use and coastal infrastructure from the Proposed Action alone to be **minor** adverse. Proposed Action O&M would also generate long-term, **minor** beneficial impacts by supporting designated uses at ports and potentially promoting port improvements and/or redevelopment, though no port improvements are currently proposed as part of this project.

Considering all the IPFs together, BOEM anticipates that the overall impacts associated with the Proposed Action when combined with past, present, and reasonably foreseeable activities would result in **minor** adverse impacts to land use and coastal infrastructure. BOEM made this call because, while port use during construction and installation could result in **moderate** adverse impacts, the overall effect when impacts are considered over the entire GAA and analysis duration would be small and the resource would be expected to recover completely.

3.14.2.3 Alternatives C, D, E, and F

Table 3.14-1 provides a summary of IPF findings for these alternatives.

3.14.2.3.1 Conclusions

Although Alternatives C through F would reduce the number of WTGs and possibly reduce the miles of IAC, these changes would not measurably affect land use and coastal infrastructure. Therefore, BOEM expects that the impacts to land use and coastal infrastructure resulting from the alternative would be similar to the Proposed Action and would result in **minor** adverse impacts, which is the same impact determination as the Proposed Action.

The overall impacts of Alternatives C through F when combined with past, present, and reasonably foreseeable activities would therefore be the same level as under the Proposed Action: **minor** adverse.

3.14.2.4 Mitigation

No potential additional mitigation measures for land use and coastal infrastructure are identified in Table F 2 in Appendix F.

3.15 Marine Mammals (see section in main EIS)

3.16 Navigation and Vessel Traffic (see section in main EIS)

3.17 Other Uses (see section in main EIS for Scientific Research and Surveys)

3.17.1 Description of the Affected Environment and Environmental Consequences of the No Action Alternative for Other Uses

Geographic analysis area: The GAAs for Other Uses are as follows (Figure 3.17-1):

Aviation and air traffic: Airspace and airports used by regional air traffic.

Land-based radar: Includes air space used by regional traffic.

Marine mineral resources and dredged material disposal: Areas within 0.25 mile of the Project and footprints of other cables and wind lease areas in the RI/MA WEA (not analyzed in detail in this chapter; see Appendix E2).

Military and national security: An area roughly bounded by Montauk, New York; Providence, Rhode Island; Provincetown, Massachusetts; and within a 10-mile buffer from wind lease areas in the RI/MA WEA.

Offshore energy uses: Other known wind energy project locations (not analyzed in detail in this chapter; see Appendix E2).

Undersea cables: Area within 1 mile of the Project and other undersea facilities and wind lease areas in the RI/MA WEA.

These areas encompass locations where BOEM anticipates direct and indirect impacts associated with Project construction and installation, O&M, and decommissioning. The scientific research survey area encompasses the locations where scientific research and surveys are anticipated to occur.

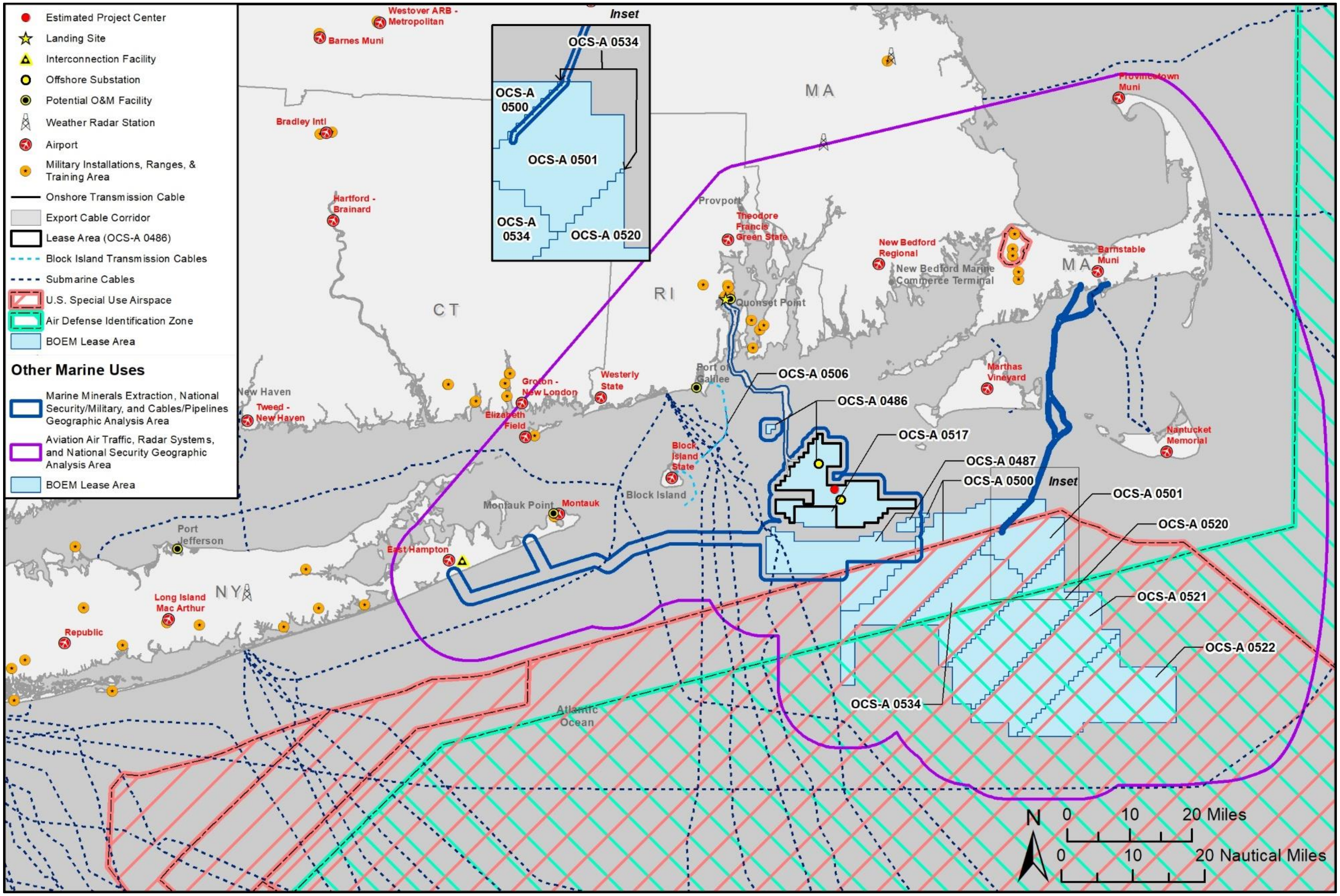

Figure 3.17-1. Geographic analysis areas for other uses.

3.17.1.1 Aviation and Air Traffic

Affected environment: Numerous public and private airports serve portions of New York, Rhode Island, and Massachusetts in the GAA. Major airports serving the region include Boston Logan International Airport, located approximately 100 miles northeast of the Project; T.F. Green Airport in Providence, Rhode Island, located approximately 50 miles north of the Project; and Montauk Airport in Montauk, New York, approximately 30 miles west of the RWF and 9 miles north of the offshore RWEC. The closest public airports to the Project are Nantucket Memorial Airport, approximately 55 miles east on Nantucket; Martha's Vineyard Airport, approximately 32 miles northeast on Martha's Vineyard; and Block Island State Airport, approximately 20 miles west on Block Island.

3.17.1.1.1 Future Offshore Wind Activities (without Proposed Action)

This section discloses potential aviation and air traffic impacts associated with future offshore wind development. Analysis of impacts associated with ongoing activities and future non–offshore wind activities is provided in Appendix E2.

Aviation and air traffic: Future offshore wind activities without the Proposed Action could result in increased air traffic due to the use of helicopters and other aircraft during construction and installation, O&M, and decommissioning of future wind projects. While the exact increase in future project-related flights is unknown, it is anticipated that future offshore wind activities would result in an increase in flight traffic for construction, ongoing wildlife surveys, and (search and rescue) SAR related to offshore wind project vessel traffic. Based on FAA (2022) data, the Proposed Action would conservatively add up to 7% to FAA-reported air traffic in the GAA for all aircraft types per year during the construction and decommissioning phases and 0.1% during O&M. It can be assumed, therefore, that other wind activities could result in similar air traffic increases, with future projects potentially overlapping in construction and/or decommissioning phases. These simplified assumptions are conservative, likely overestimate future air traffic, and do not account for aircraft concentration near New England region airports. Future offshore wind project air traffic would be required to engage the FAA in flight planning to avoid impacts to civilian, commercial, government, and military aviation operations. With implementation of FAA-approved flight plans, impacts of the No Action Alternative on aviation and air traffic would be **negligible** adverse.

Light: Future offshore wind activities without the Proposed Action would result in an increase in permanent aviation warning lighting on WTGs offshore. All existing stationary structures would have navigation marking and lighting in accordance with FAA, USCG, and BOEM guidance to minimize collision risks and optimize aviation safety. The addition of up to 1,036 lighted structures represents a substantive increase in the number and extent of aviation and navigation safety lighting systems operating within the GAA, an area that includes lighting from military, commercial, and construction vessels; vessel-related lighting such as buoys and towers; and onshore lighting from housing and ports. Therefore, the effects of light on aviation and air traffic under the No Action Alternative would be **minor** adverse.

Port utilization: There may be a minimal increase in vessel use at ports associated with the No Action Alternative. The number of construction vessels would increase due to future offshore wind activities without the Proposed Action, which could result in delays and congestion at ports and lead to potential conflicts with air traffic due to increased activity in the vicinity of the airports listed in Section 3.17.1.1. Port improvements and construction activities in or near ports may require alteration of navigation patterns at nearby airports. Navigational hazards and collision risks at ports and in transit routes would be reduced as construction is completed, and all navigation hazards and collision risks would be gradually eliminated during decommissioning as offshore WTGs are removed. In addition, vessel traffic would be spread among multiple ports to ensure sufficient capacity exists at each port and in each waterway. Therefore, port utilization is expected to have a **negligible** adverse effect on aviation and air traffic.

Presence of structures: Future offshore wind development could add up to 1,036 structures to the offshore environment in the analysis area. WTGs could have maximum blade tip height of 1,171 feet (357 m) amsl. Addition of these structures would noticeably increase navigational complexity and change aircraft navigation patterns in the region around the leased areas offshore Massachusetts and Rhode Island, along transit routes between ports and construction sites, and locally around ports (see Port Utilization). These changes could compress lower-altitude aviation activity into more limited airspace in these areas, leading to airspace conflicts or congestion, and increasing collision risks for low-flying aircraft. However, open airspace around the RI and MA Lease Areas would still be available over the open ocean, and ports used for offshore WTG construction would be planned and developed to accommodate tall structures.

Open airspace around the Lease Areas would still exist after all foreseeable future offshore wind energy projects are built. BOEM assumes that offshore wind project operators would coordinate with aviation interests throughout the planning, construction and installation, O&M, and decommissioning process to avoid or minimize impacts on aviation activities and air traffic. For this reason, the effects of increased presence of structures to aviation and air traffic under the No Action Alternative are anticipated to be **minor** adverse.

Vessel traffic: Although no future non–offshore wind stationary structures were identified within the Lease Area, vessel traffic associated with future offshore wind projects located outside the Lease Area would result in increased vessel traffic in the RI/MA WEA and surrounding ports. The impacts of increased vessel traffic are discussed above under Port Utilization and Presence of Structures. Vessel traffic is expected to have a **negligible** adverse effect on aviation and air traffic because vessel traffic would be spread throughout a large geographic area, and while construction time frames may overlap, it is anticipated that the increase in vessel traffic would not impact aviation and air traffic.

3.17.1.1.2 Conclusions

Under the No Action Alternative, BOEM would not approve the COP; Project construction and installation, O&M, and decommissioning would not occur; and potential impacts on other uses associated with the Project would not occur. However, ongoing and future activities would have **minor** adverse impacts on aviation uses due to the presence of structures that introduce navigational complexities.

BOEM anticipates that impacts to aviation uses from the combination of most ongoing activities and reasonably foreseeable activities other than offshore wind would be **negligible** adverse because any issues with aviation routes would be resolved through coordination with the FAA, as well as through implementation of navigational marking of structures according to FAA, USCG, and BOEM requirements and guidelines.

Considering all the IPFs together, BOEM anticipates that the impacts associated with future offshore wind activities in the GAA combined with ongoing activities, reasonably foreseeable environmental trends, and reasonably foreseeable activities other than offshore wind would result in **minor** adverse impacts for aviation uses.

3.17.1.2 Land-Based Radar

Affected environment: Several radar systems supporting commercial air traffic control, national defense, weather forecasting, and ocean condition observation operate near the Project (Westslope Consulting, LLC [Westslope] 2021). Six high-frequency airport surveillance (ASR) radar sites are located near the Project: Boston ASR-9, Falmouth ASR-8, Nantucket ASR-9, North Truro ARSR-4, Providence ASR-9, and Riverhead ARSR-4. The study area is beyond the instrumented range of the Boston ASR-9.

Three navigational aid sites are near the Project: Martha's Vineyard VOR/DME, the Providence VOR/DME, and Sandy Point VOR/DME. Two NEXRAD weather radar systems, the Boston WSR-88D and Brookhaven WSR-88D, are located near the Project.

There are 13 high-frequency radar sites located near the Project:

- Amagansett HF radar (operated by Rutgers University)
- Block Island Long Range HF radar (two radars operated by the University of Rhode Island and Rutgers University)
- Camp Varnum HF radar (operated by Woods Hole Oceanographic Institution)
- Horseneck Beach State Reservation HF radar (operated by Woods Hole Oceanographic Institution)
- Long Point Wildlife Refuge HF radar (operated by Woods Hole Oceanographic Institution)
- Martha's Vineyard HF radar
- Moriches HF radar (operated by Woods Hole Oceanographic Institution)
- Martha's Vineyard Coastal Observatory (MVCO) Meteorological Mast HF radar (operated by Woods Hole Oceanographic Institution)
- Nantucket Island HF radar (two radars operated by Rutgers University and Woods Hole Oceanographic Institution).
- Nauset HF radar (operated by the University of Massachusetts Dartmouth)
- Squibnocket Farms HF radar (operated by Woods Hole Oceanographic Institution)

3.17.1.2.1 Future Offshore Wind Activities (without Proposed Action)

This section discloses potential radar impacts associated with future offshore wind development. Analysis of impacts associated with ongoing activities and future non–offshore wind activities is provided in Appendix E2.

Presence of structures: WTGs that are near or in direct line-of-sight to land-based radar systems can interfere with the radar signal causing shadows or clutter in the received signal. WTGs can also affect HF radar measurements of coastal ocean currents, oil spill tracking, and vessel drift tracking (BOEM 2020). Modeling completed on behalf of BOEM (2020) shows that small aircraft detection interference would occur in the vicinity of each WTG. Construction of 1,036 structures in the RI/MA WEA could lead to long-term, **minor** adverse cumulative impacts to radar systems. While these structures would be sited at such a distance from existing and proposed land-based radar systems to minimize interference to most radar systems, event-based operational changes and modification of some land-based radar may be necessary. Event-based operational change may include wind farm curtailment agreements for BOEM lease areas that would cease wind farm operations when HF radar efficiency is essential, such as in the event of a severe hurricane/tropical storm or a large oil spill. BOEM (2020) is also currently developing a software upgrade for land-based HF radar to minimize impacts from offshore wind energy facilities. For vessel-based radar, the final Massachusetts and Rhode Island Port Access Route Study (USCG 2020) concludes that general mitigation measures, such as properly trained vessel-based radar operators, properly installed and adjusted vessel equipment, marked wind turbines, and the use of AIS would enable safe navigation in the GAA with minimal loss of radar detection.

Vessel traffic: Although no future non–offshore wind stationary structures were identified within the Lease Area, construction and operational vessel traffic from future offshore wind development outside the Lease Area is expected to increase. This could impact land-based radar by increasing the number of vessels in the analysis area. BOEM assumes that all offshore wind developments in the GAA would use the developer agreed upon 1 × 1–nm spacing that aligns with other proposed adjacent offshore wind projects in the RI/MA WEA. This would allow more space for vessels to navigate and would help reduce potential interference on radar systems. As a result, the effects of vessel traffic on land-based radar under the No Action Alternative would be **minor** adverse.

3.17.1.2.2 Conclusions

Under the No Action Alternative, BOEM would not approve the COP; Project construction and installation, O&M, and decommissioning would not occur; and potential impacts on other uses associated with the Project would not occur. However, ongoing and future activities would have **minor** adverse impacts on other uses due to the presence of structures that increase radar interference.

BOEM anticipates that impacts to radar would be **negligible** adverse for any individual ongoing and reasonably foreseeable activity other than offshore wind because any issues with radar systems would be resolved through coordination with the Department of Defense (DOD) or FAA.

Considering all the IPFs together, BOEM anticipates that the impacts associated with future offshore wind activities in the GAA combined with ongoing activities, reasonably foreseeable environmental trends, and reasonably foreseeable activities other than offshore wind would result in notable and **moderate** adverse impacts to radar systems due to combined WTG interference.

3.17.1.3 Military and National Security

Affected environment: The U.S. Navy, the USCG, and other military entities have numerous facilities in the region. Major onshore regional facilities include Naval Station Newport, the Naval Submarine Base New London, the Northeast Range Complex/Narragansett Bay Operation Area, Joint Base Cape Cod, and numerous USCG stations (Epsilon Associates, Inc. 2018). Onshore and offshore military use areas could have designated surface and subsurface boundaries and special use airspace. The Project is entirely within the Navy's Narragansett Operating Area in which national defense training exercises and system qualification tests are routinely conducted (MARCO 2021). This operating area extends approximately

100 miles south and 200 miles east of the Project. The Project is approximately 10 miles north of a Military Special Use Airspace (FK Facility Narragansett Bay) and 20 miles northeast of the closest submarine transit lanes. A DOD assessment of compatibility of offshore wind development with military assets and activities determined that potential conflicts exist in the area surrounding the Project and could require site-specific mitigation measures (OCM 2019).

3.17.1.3.1 Future Offshore Wind Activities (without Proposed Action)

This section discloses potential military and national security impacts associated with future offshore wind development. Analysis of impacts associated with ongoing activities and future non–offshore wind activities is provided in Appendix E1.

Anchoring and new cable emplacement/maintenance: Up to 12,196 acres could be affected by anchoring and mooring activities and cable installation during offshore wind energy development within the analysis area. This offshore energy facility construction of new cable emplacement and maintenance of cables would involve increased vessel traffic which could impact military and national security uses by increasing the number of vessels within the analysis area. Increased vessel traffic due to anchoring and cable maintenance of wind facilities could lead to course changes of military vessels, thereby increasing navigational complexity and risk of collisions. However, these impacts are expected to be low because military vessels would largely travel in transit lanes, with the exception of SAR operations, and short term due to the limited amount of cable emplacement and maintenance expected from future offshore wind activities. Therefore, the effects of anchoring and new cable emplacement and maintenance under the No Action Alternative on military and national security would be **negligible** adverse**.**

Aviation and air traffic: Future offshore wind activities could result in increased air traffic due to the use of helicopters and other aircraft during construction and installation, O&M, and decommissioning of future wind projects that in turn may increase the necessity for data collection and SAR operations. While the exact increase in future project-related flights is unknown, it is anticipated that future offshore wind-related flight traffic would be low and would be unlikely to affect military use of the area in SAR and data collection activities. Future offshore wind projects would be required to engage the FAA in flight planning to avoid impacts to civilian, commercial, government, and military aviation operations. With implementation of FAA-approved flight plans, impacts of the No Action Alternative on military and national security would be **negligible** adverse**.**

Light: Future offshore wind activities would result in an increase in permanent aviation warning lighting on WTGs offshore. All existing stationary structures would have navigation marking and lighting in accordance with FAA, USCG, and BOEM guidance to minimize allision risks. Implementation of navigational lighting and marking per FAA and BOEM requirements and guidelines would further reduce the risk of military aircraft collisions. This increase in lighting would add to vessel and navigational lighting, as well as onshore housing and port lighting, in the GAA, which could have a negative impact on military and national. Therefore, the effects of light on military and national security under the No Action Alternative would be **minor** adverse.

Presence of structures: Installation of up to 1,036 structures in the RI/MA WEA, which currently supports only five offshore wind turbines associated with the BIWF, as well as several meteorological buoys (see Appendix E1), would impact military and national security vessels primarily through risk of allision and collision with stationary structures and other vessels. Vessels could directly allide with WTG foundations.

Vessel traffic would increase during project construction, and once the WTGs are operational, the artificial reef effect created by offshore structures could attract commercial and recreational fishing vessels. This would increase the risk of vessel collisions and increase navigation complexity, leading to potential use conflicts. In general, risks to military and national security vessels would increase over time as additional wind energy facilities are built.

Military and national security vessels could allide with WTG structures. However, deep-draft military vessels are not anticipated to transit outside of navigation channels unless necessary for SAR (of people or marine mammals) or nontypical operations. Allision risks for smaller vessels moving within or near offshore wind structures would be higher. However, these risks would be minimized by projects adhering to structural lighting requirements according to the USCG and BOEM, which would provide lighting at sea level. Additionally, allision would be further mitigated by following a fixed 1 × 1–nm WTG layout proposed by offshore wind leaseholders to facilitate safe navigation through the offshore wind energy Lease Areas (Geijerstam et al. 2019).

Additionally, risk of collision with recreational fishing vessels could indirectly increase as a result of the artificial reef effect around the offshore wind facility structures. New artificial reef effects could attract recreational fishing vessels farther offshore than currently occurs, adding to existing vessel traffic and subsequently increasing the risk of collision with military and national security vessels. Furthermore, an increase in recreational vessels in and around offshore wind projects could increase the demand for USCG SAR operations (of people or marine mammals).

In addition to allision or collision risks, military and national security vessels may be impacted by offshore wind energy structures by the need to change routes and navigate around both project footprints and project-associated vessels, particularly during the construction periods between 2021 and 2030. Furthermore, military and national security vessels may experience congestion and delays in port due to the increase in offshore wind facility vessels.

Military and national security aircraft would be impacted by the presence of tall equipment necessary for offshore wind facility construction, such as stationary lift vessels and cranes, which would increase navigational complexity in the area. Warning area W-105A measures approximately 23,000 square miles, with approximately 4% (approximately 1,000 square miles) overlaying the GAA (BOEM 2021). Military and national security operations conducted within W-105A would be impacted during construction and operation periods. However, it is assumed all offshore wind energy project operators would coordinate with relevant agencies during the COP development process to identify and minimize conflicts with military and national security operations.

Measures mitigating risks would include operational protocol to stop WTG rotation during SAR aircraft operations and implementation of FAA- and BOEM-recommended navigational lighting and marking to reduce the risk of aircraft collisions. Wind energy structures would be visible on military and national security vessel and aircraft radar. Nonetheless, the presence and layout of large numbers of WTGs could make it more difficult for SAR aircraft to perform operations (of people or marine mammals), leading to less effective search patterns or earlier abandonment of searches. This could result in otherwise avoidable loss of life due to maritime incidents.

Navigational hazards would gradually be eliminated as structures are removed. Based on coordinating efforts and the anticipated mitigating measures discussed above, the overall impacts to military and national security uses are anticipated to be **moderate** adverse under the No Action Alternative.

Vessel traffic: Although no future non–offshore wind stationary structures were identified within the Lease Area, increased vessel traffic due to construction and decommissioning of future offshore wind facilities outside the Lease Area could lead to course changes of military and national security vessels, congestion and delays at ports, and increased traffic along vessel transit routes. Vessel activity could peak in 2025 with as many as 276 vessels involved in construction of reasonably foreseeable projects. While construction periods of various wind energy facilities may be staggered, some overlap would result in a cumulative impact to traffic loads. Therefore, the effects of vessel traffic on military and national security under the No Action Alternative would be **minor** adverse.

3.17.1.3.2 Conclusions

Under the No Action Alternative, BOEM would not approve the COP; Project construction and installation, O&M, and decommissioning would not occur; and potential impacts on other uses associated with the Project would not occur. However, ongoing and future activities would have **moderate** adverse impacts on military and national security uses due to the presence of structures that introduce navigational complexities and vessel traffic.

BOEM anticipates that impacts to military and national security uses from the combination of most ongoing activities and reasonably foreseeable activities other than offshore wind would be **negligible** adverse because BOEM anticipates that any issues with the military or national security would be resolved through coordination with the DOD, as well as through implementation of navigational marking of structures according to FAA, USCG, and BOEM requirements and guidelines.

Considering all the IPFs together, BOEM anticipates that the impacts associated with future offshore wind activities in the GAA combined with ongoing activities, reasonably foreseeable environmental trends, and reasonably foreseeable activities other than offshore wind would result in **moderate** adverse impacts for military and national security uses.

3.17.1.4 NOAA’s Scientific Research and Surveys (see section in main EIS)

3.17.1.5 Undersea Cables

Affected environment: There are existing submarine cables that run through the regional waters. Most pass through Green Hill, Rhode Island. In addition, there are NOAA nautical chart cable and pipeline areas that denote where such infrastructure may be located. The existence of these areas does not necessarily mean that actual cables or pipeline are present (BOEM 2013). Other than cables for other offshore wind projects, BOEM has not identified any publicly noticed plans for additional submarine cables or pipelines; therefore, no new cable installation is reasonably foreseeable for the purposes of this EIS.

3.17.1.5.1 Future Offshore Wind Activities (without Proposed Action)

This section discloses potential undersea cable impacts associated with future offshore wind development. Analysis of impacts associated with ongoing activities and future non–offshore wind activities is provided in Appendix E2.

Presence of structures: Up to 1,036 structures could be installed between 2021 and 2030 in the RI/MA WEA as part of future offshore wind energy project infrastructure. The presence of future offshore wind energy structures could preclude future submarine cable placement, as discussed in Appendix E2 in "Anchoring and new cable emplacement/maintenance." Installed WTGs and OSSs and stationary lift vessels used during construction that are located near existing submarine cables could pose allision risks and navigational hazards to vessels conducting maintenance activities on these cables. The future development of multiple wind energy projects could increase the complexity of undersea cable development by requiring routing around the facilities. Export cables are unlikely to preclude future undersea cable development because cable crossings can be protected using standard design techniques. Therefore, in context of reasonably foreseeable environmental trends, the overall impacts from the presence of structures resulting from ongoing and planned actions are anticipated to be localized long term **negligible** adverse because impacts can be avoided by routing design and standard cable protection techniques.

Vessel traffic: Although no future non–offshore wind stationary structures were identified within the Lease Area, increased vessel traffic due to construction and installation of future offshore wind activities located outside the Lease Area could interfere with vessels used to install or maintain existing and future undersea cables. Increased vessel traffic due to Project construction and installation, O&M, and decommissioning could lead to course changes of vessels used for undersea cable maintenance and installation and increased traffic along vessel transit routes. The risk of allision to cable maintenance vessels could increase as more offshore wind energy projects are constructed. However, given the infrequency of required maintenance at any given location along a cable route, this risk is expected to be low. Therefore, the effects of vessel traffic on undersea cables under the No Action Alternative would be **negligible** adverse**.**

3.17.1.5.2 Conclusions

Under the No Action Alternative, BOEM would not approve the COP; Project construction and installation, O&M, and decommissioning would not occur; and potential impacts on other uses associated with the Project would not occur. Ongoing and future activities would have **negligible** adverse impacts on undersea cables due to the presence of offshore wind energy cables or structures that could preclude future submarine cable placement and vessel traffic.

BOEM anticipates that impacts to undersea cables from the combination of most ongoing activities and reasonably foreseeable activities other than offshore wind would be **negligible** adverse because BOEM anticipates that cables could be easily crossed by vessels and existing cables require minimal maintenance.

Considering all the IPFs together, BOEM anticipates that the impacts associated with future offshore wind activities in the GAA combined with ongoing activities, reasonably foreseeable environmental trends, and reasonably foreseeable activities other than offshore wind would result in **negligible** adverse impacts on undersea cables.

3.17.2 Environmental Consequences

3.17.2.1 Relevant Design Parameters, Impact-Producing Factors, and Potential Variances in Impacts

The analysis presented in this section considers the impacts resulting from the maximum design scenario under the project design envelope (PDE) approach developed by BOEM to support offshore wind project development (Rowe et al. 2017). The maximum design size specifications defined in Appendix D, Table D-1, are PDE parameters used to conduct this analysis.

The following design parameters would result in different impacts relative to those generated by the design elements considered under the PDE:

- The selection of lower capacity WTG designs would reduce the total WTG height from 873 to as low as 648 feet, reducing impacts to aviation and air traffic, land-based radar, and military and national security.

See Appendix E1 for a summary of IPFs analyzed for other uses across all action alternatives. IPFs that are either not applicable to the resource or determined by BOEM to have a negligible adverse effect are excluded from Chapter 3 and provided in Appendix E1, Tables E2-15 to E2-21. Other uses subsections (NOAA's scientific research and surveys) are discussed in the main EIS.

Table 3.17-1 provides a summary of IPF findings carried forward for analysis in this section. Each alternative analysis discussion consists of the construction and installation phase, the O&M phase, the decommissioning phase, and the cumulative analysis. If these analyses are not substantially different, then they are presented as one discussion. This comparison considers the implementation of all EPMs proposed by Revolution Wind to avoid and minimize adverse impacts on other uses. These EPMs are summarized in Appendix F, Table F-1.

A detailed analysis of the Proposed Action is provided following the table. Detailed analysis of other considered action alternatives is also provided below the table if analysis indicates that the alternative(s) would result in substantially different impacts than the Proposed Action. Offshore and onshore IPFs are addressed separately in the analysis if appropriate for the resource; not all IPFs have both an offshore and onshore component. Where feasible, calculations for specific alternative impacts are provided in Appendix E4, to facilitate reader comparison across alternatives.

The Conclusion section within each alternative analysis discussion includes rationale for the effects determinations. The overall effect determination for each alternative is **minor** adverse impacts for aviation and air traffic; **moderate** adverse for land-based radar; **moderate** adverse for military uses; and **negligible** adverse for undersea cables.

Table 3.17-1. Alternative Comparison Summary for Other Uses

Impact-Producing Factor	No Action Alternative	Alternative B (Proposed Action) Up to 100 WTGs	Alternative C (Habitat Alternative) 64 or 65 WTGs	Alternative D (Transit Alternative) 78 to 93 WTGs	Alternative E (Viewshed Alternative) 64 or 81 WTGs	Alternative F (Higher Capacity Turbine Alternative) 56 WTGs
Aviation and Air Traffic						
Aviation and air traffic	**Offshore:** Future offshore wind activities without the Proposed Action could result in increased air traffic due to the use of helicopters and other aircraft during construction and installation, O&M, and decommissioning of future wind projects. With implementation of FAA-approved flight plans, however, impacts of the No Action Alternative on aviation and air traffic would be **negligible** adverse.	**Offshore:** The Proposed Action would result in an increase in air traffic related to construction and installation of offshore Project elements. A helicopter route plan would be developed to meet industry guidelines and best practices in accordance with FAA guidance. Additionally, all aviation operations, including flying routes and altitude, would be aligned with relevant stakeholders, such as the FAA. On this basis, the effects of Project-related aviation and air traffic on aviation and air traffic under the Proposed Action would be **minor** adverse. Helicopter flights for Project O&M would represent a 0.1% increase in annual helicopter flight hours and a 0.01% increase in general aviation hours in the GAA. When estimation uncertainty is considered, this represents a **negligible** adverse effect on general aviation air traffic. The Proposed Action and reasonably foreseeable future wind projects would be required to engage the FAA in flight planning to avoid impacts to civilian, commercial, government, and military aviation operations. Therefore, the Proposed Action when combined with past, present, and other reasonably foreseeable project impacts would result in **negligible** adverse impacts on aviation and air traffic.	**Offshore:** This alternative could require fewer construction and O&M–related helicopter trips due to the reduction in the number of offshore elements, incrementally reducing the number of construction-related helicopter trips. While Alternatives C to F could result in slightly reduced air traffic, the effects of this IPF on aviation and air traffic under each alternative would otherwise be similar to those described for the Proposed Action: **minor** adverse for construction and **negligible** adverse for O&M and cumulative impacts.			
Light	**Offshore:** Future offshore wind activities without the Proposed Action would result in an increase in permanent aviation warning lighting on WTGs offshore. The addition of up to 1,036 lighted structures represents a small increase in the combined vessel, navigation, housing, and port lights within the GAA; therefore, the effects of light on aviation and air traffic under the No Action Alternative would be **minor** adverse.	**Offshore:** During construction and installation and O&M, WTGs would be marked with appropriate lighting to meet FAA warning guidelines and would be visible on the radar systems of low-flying aircraft, similar to other large-scale sea surface activity. Therefore, impacts to aviation and air traffic would be **negligible** adverse. BOEM estimates a maximum cumulative total of up to 1,138 offshore WTGs and OSS foundations for the Proposed Action plus all other future offshore wind projects in the RI/MA WEA. All existing stationary structures would have navigation marking and lighting in accordance with FAA, USCG, and BOEM guidelines to minimize collision and allision risks. WTGs would also be visible on aircraft radar. Therefore, the cumulative impacts associated with the Proposed Action when combined with past, present, and reasonably foreseeable activities would have a **negligible** adverse impact on aviation and air traffic.	**Offshore:** Under Alternatives C through F, fewer lighted WTG locations would be approved by BOEM when compared to the maximum-case scenario under the Proposed Action. However, this slight reduction in lighting would not be expected to measurably reduce aviation and air traffic impacts compared to those impacts described under the Proposed Action. Therefore, the impact on aviation and air traffic under each alternative would be **negligible** adverse for all Project phases.			
	Onshore: See offshore analysis.	**Onshore:** Operational lighting onshore would be limited to the OnSS and ICF, which would have minimal yard lighting and task lighting. This lighting is minimal and would not result in impacts to aviation and air traffic. Decommissioning would have impacts similar to those during Project construction. Therefore, the effects of light on aviation and air traffic under the Proposed Action would be **negligible** adverse.	**Onshore:** Alternatives C through F would consist of the same onshore facilities and activities as those planned under the Proposed Action. Therefore, onshore impacts to aviation and air traffic from Project activities would be **negligible** adverse.			

Impact-Producing Factor	**No Action Alternative**	**Alternative B (Proposed Action) Up to 100 WTGs**	**Alternative C (Habitat Alternative) 64 or 65 WTGs**	**Alternative D (Transit Alternative) 78 to 93 WTGs**	**Alternative E (Viewshed Alternative) 64 or 81 WTGs**	**Alternative F (Higher Capacity Turbine Alternative) 56 WTGs**
Port utilization	**Offshore:** Port improvements and construction activities in or near ports may also require alteration of navigation patterns at nearby airports. However, vessel traffic would also be spread among multiple ports to ensure sufficient capacity exists at each port and in each waterway. Therefore, port utilization is expected to have a **negligible** adverse effect on aviation and air traffic.	**Offshore:** Port improvements and construction activities in or near ports may require alteration of navigation patterns at nearby airports. However, vessel traffic would also be spread among multiple ports to ensure that sufficient capacity exists at each port and in each waterway. Therefore, port utilization is expected to have a **negligible** adverse effect on aviation and air traffic.	**Offshore:** Alternatives C through F would require a shorter construction duration, a smaller construction footprint, and fewer offshore structures. While Alternatives C through F could result in a slight reduction in port utilization, the effects of this IPF on aviation and air traffic under Alternatives C through F would otherwise be similar to those described for the Proposed Action and would therefore be **negligible** adverse for all Project phases**.**			
	Onshore: See offshore analysis.	**Onshore:** Ports would be primarily used during construction and installation of the Proposed Action, as ports would be used for staging WTGs and mobilizing construction work. Decommissioning would have impacts similar to those during Project construction. There would be no impacts to aviation and air traffic from O&M and decommissioning of the Proposed Action; therefore, impacts would be **negligible** adverse. Cumulative impacts associated with the Project when combined with past, present, and reasonably foreseeable future activities would be **minor** adverse on aviation and air traffic.	**Onshore:** Alternatives C through F would consist of the same onshore facilities and activities as those planned under the Proposed Action. Therefore, onshore impacts to aviation and air traffic from Project activities would be **negligible** to **minor** adverse.			
Presence of structures	**Offshore:** Future offshore wind development could add up to 1,036 structures to the offshore environment in the GAA. BOEM assumes that offshore wind project operators would coordinate with aviation interests throughout the planning, construction and installation, O&M, and decommissioning process to avoid or minimize impacts on aviation activities and air traffic. For this reason, the effects of the increased presence of structures to aviation and air traffic under the No Action Alternative are anticipated to be **minor** adverse.	**Offshore:** The Proposed Action would add up to 100 WTGs with maximum blade tip heights of up to 853 feet amsl. The addition of these structures would increase navigational complexity and could change aircraft navigation patterns for aircraft flying at low altitudes and for airports in the vicinity, increasing collision risks for some aircraft during the Proposed Action's operational time frame. However, more than 90% of existing air traffic in the GAA would occur at altitudes that would not be impacted by the presence of WTGs (BOEM 2021). Therefore, the effects of the presence of structures on aviation and air traffic under the Proposed Action would be **negligible** adverse. BOEM estimates a cumulative total of up to 1,138 offshore WTGs and OSS foundations for the Proposed Action plus all other future offshore wind projects in the RI/MA WEA. Therefore, the Proposed Action when combined with past, present, and other reasonably foreseeable Project impacts would result in a **minor** adverse impact on aviation and air traffic.	**Offshore:** Under Alternatives C through F, fewer WTG locations would be approved by BOEM, which would result in a noticeably smaller offshore impact compared to the maximum case under the Proposed Action. The effects of this IPF would be the same or slightly reduced to those described for the Proposed Action and would therefore be **negligible** adverse for construction and O&M, and **minor** adverse for cumulative impacts.			
	Onshore: See offshore analysis.	**Onshore:** The O&M of onshore structures to support the Proposed Action would not impact aviation and air traffic. This IPF would result in a **negligible** adverse impact because there would be no effect on this resource.	**Onshore:** Alternatives C through F would consist of the same onshore facilities and activities as those planned under the Proposed Action. Therefore, onshore impacts to aviation and air traffic from Project activities would be **negligible** adverse.			

Impact-Producing Factor	No Action Alternative	Alternative B (Proposed Action) Up to 100 WTGs	Alternative C (Habitat Alternative) 64 or 65 WTGs	Alternative D (Transit Alternative) 78 to 93 WTGs	Alternative E (Viewshed Alternative) 64 or 81 WTGs	Alternative F (Higher Capacity Turbine Alternative) 56 WTGs
Vessel traffic	**Offshore:** Vessel traffic is expected to have a **negligible** adverse effect on aviation and air traffic because vessel traffic would be spread throughout a large geographic area, and while construction time frames may overlap, it is anticipated that the slight increase in vessel traffic would not impact aviation and air traffic.	**Offshore:** Vessel traffic associated with the Proposed Action would result in increased vessel traffic in the Lease Area and around ports. Construction of offshore structures would incrementally noticeably increase navigational complexity along transit routes between ports and construction sites, and locally around ports, due to increased vessel traffic. Increased vessel traffic is expected to have a **negligible** adverse effect on aviation and air traffic because vessel traffic would be spread throughout a large geographic area and would occur over a short period of time. Vessel traffic associated with the Proposed Action and reasonably foreseeable future actions would result in increased vessel traffic in the GAA. Therefore, the Proposed Action when combined with past, present, and other reasonably foreseeable project impacts would result in a **minor** adverse impact on aviation and air traffic.	**Offshore:** Under Alternatives C through F, fewer WTG locations would be approved by BOEM. Construction and installation vessel traffic may result in slightly reduced vessel traffic in the Lease Area and around ports given the smaller offshore footprint. Reduced navigational complexity combined with a smaller construction footprint and fewer offshore structures would result in the effects of this IPF being the same or slightly reduced relative to those described for the Proposed Action. Therefore, impacts would be **negligible** adverse for construction and O&M and **minor** adverse for cumulative impacts.			
	Onshore: See offshore analysis.	**Onshore:** Onshore vehicle traffic may increase as a result of O&M and decommissioning of the Proposed Action but would not impact aviation and air traffic because aviation and air traffic uses are generally spatially separate from vehicular traffic and occur in different locations. Therefore, this IPF would result in a **negligible** adverse impact because minimal increases in vehicle traffic would not impact aviation and air traffic.	**Onshore:** Alternatives C through F would consist of the same onshore facilities and activities as those planned under the Proposed Action. Therefore, onshore impacts to aviation and air traffic from Project activities would be **negligible** adverse.			
Military and National Security (including search and rescue)						
Anchoring and new cable emplacement/ maintenance	**Offshore:** Offshore energy facility construction of new cable emplacement and maintenance of cables would involve increased vessel traffic, which could impact military and national security uses by increasing the number of vessels within the GAA. Increased vessel traffic due to anchoring and cable maintenance of wind facilities could lead to course changes of military vessels, thereby increasing navigational complexity and risk of collisions. However, these impacts are expected to be limited as cable emplacement vessels would be restricted to emplacement corridors and activities would be of short duration for future offshore wind activities. Therefore, the effects of anchoring and new cable emplacement and maintenance under the No Action Alternative on military and national security would be **negligible** adverse.	**Offshore:** Anchoring and mooring activities would involve increased vessel traffic, which could impact military and national security uses by increasing the number of vessels within the GAA. However, the impacts are expected to be limited as cable emplacement vessels would be restricted to emplacement corridors and activities would be of short duration during construction and installation of offshore Project elements. Therefore, the effects of anchoring and new cable emplacement and maintenance under the Proposed Action on military and national security would be **negligible** adverse. Project activities combined with reasonably foreseeable activities would result in a substantive increase in vessel traffic during cable emplacement and maintenance, contributing to a **minor** adverse impact on military and national security.	**Offshore:** Because the impact would be slightly reduced regardless of the configuration selected, all offshore impacts under Alternatives C through F would be slightly reduced compared to the Proposed Action. The effects of this IPF would therefore be **negligible** to **minor** adverse.			
Aviation and air traffic	**Offshore:** Future offshore wind activities could result in increased air traffic due to the use of helicopters and other aircraft during construction and installation, O&M, and decommissioning of future wind projects. With implementation of FAA-approved flight plans, however,	**Offshore:** Construction and installation of the Proposed Action would result in a 7% increase in general aviation in the GAA. Therefore, the effects of this IPF on military and national security under the Proposed Action would be **minor** adverse.	**Offshore:** Alternatives C through F would require fewer construction-related helicopter trips due to the reduction in the number of offshore elements. However, the effects of this IPF on military and national security would otherwise be similar to those described for the Proposed Action: **negligible** adverse for O&M and **minor** adverse for construction and cumulative impacts.			

Impact-Producing Factor	No Action Alternative	Alternative B (Proposed Action) Up to 100 WTGs	Alternative C (Habitat Alternative) 64 or 65 WTGs	Alternative D (Transit Alternative) 78 to 93 WTGs	Alternative E (Viewshed Alternative) 64 or 81 WTGs	Alternative F (Higher Capacity Turbine Alternative) 56 WTGs
	impacts of the No Action Alternative on military and national security would be **negligible** adverse.	O&M of the Proposed Action would result in a 0.01% increase in general aviation in the GAA. Therefore, the effects of this IPF on military and national security would be **negligible** adverse. The Proposed Action and reasonably foreseeable future wind projects would be required to engage the FAA in flight planning to avoid impacts to civilian, commercial, government, and military aviation operations. Therefore, the Proposed Action when combined with past, present, and other reasonably foreseeable project impacts would result in **minor** adverse impacts on military and national security.				
Light	**Offshore:** Future offshore wind activities would result in an increase in permanent aviation warning lighting on WTGs offshore, which would add to vessel and navigational lighting, as well as onshore housing and port lighting, in the GAA, which could have a negative impact on military and national security. Therefore, the effects of light on military and national security under the No Action Alternative would be **minor** adverse.	**Offshore:** The Proposed Action would result in an increase in temporary construction aviation warning lighting on WTGs offshore, which could have **minor** adverse impacts. The O&M and decommissioning of the Proposed Action would result in an increase in permanent lighting on WTGs offshore until decommissioning is complete. The addition of permanent lighting would be an ongoing impact; therefore, the effects of light on military and national security under the Proposed Action would be **minor** adverse. The Project, with reasonably foreseeable future actions, could result in the addition of up to 1,138 lighted structures in the GAA. Therefore, the cumulative impacts of light on military and national security would be **minor** adverse.	**Offshore:** Under this alternative, fewer lighted WTG locations would be approved by BOEM. While Alternatives C through F could result in a reduction in construction lighting, the effects of this IPF on military and national security uses would otherwise be similar to those described for the Proposed Action. Therefore, the impact on military and national security uses would be **minor** adverse.			
Presence of structures	**Offshore:** Installation of up to 1,036 structures in the RI/MA WEA would impact military and national security vessels primarily through risk of allision and collision with stationary structures and other vessels. Based on coordinating efforts and anticipated mitigating measures, however, the overall impacts to military and national security uses are anticipated to be **moderate** adverse.	**Offshore:** Construction of the Proposed Action would increase the risk of collisions and allisions for military and national security vessels or aircraft within the WEA. Structures would be marked as a navigational hazard per FAA, BOEM, and USCG requirements, and risk would be consistent within the 35-year operational period. The Project's 1 × 1–nm spacing reduces some of the risk of collisions and allisions. Therefore, the Project would have **minor** to **moderate** adverse impacts on military operations and national security. The presence of additional recreational vessels would add to conflict or collision risks for military and national security vessels and could increase demand for SAR operations. Therefore, the Project would have **minor** adverse O&M impacts on military operations and national security. The Proposed Action structures represent a 10% increase over total estimated WTG and OSS foundations across the GAA under the No Action Alternative. Therefore, the cumulative impacts associated with the Proposed Action when combined with past, present, and reasonably foreseeable activities would consist predominately of impacts described under the No Action Alternative, which would be **moderate** adverse.	**Offshore:** While the offshore footprint would be reduced under all configurations, the effects of this IPF on military and national security uses under Alternatives C through F would otherwise be similar to those described for the Proposed Action. Therefore, the impact of this IPF on military and national security uses would be **minor** to **moderate** adverse.			
Vessel traffic	**Offshore:** Increased vessel traffic due to construction and decommissioning of future offshore wind facilities could lead to course changes of military and national security vessels, congestion and delays at ports, and increased traffic along vessel transit routes. Therefore, the effects of vessel traffic on	**Offshore:** Increased vessel traffic could impact military and national security uses by increasing the number of vessels in the GAA. The RWF's proposed 1 × 1–nm spacing would result in more space for vessels to navigate and would help reduce conflicts with military vessels. As a result,	**Offshore:** Vessel traffic associated with Alternatives C through F may result in slightly reduced vessel traffic in the Lease Area and around ports given the smaller offshore footprint. While the offshore footprint would be reduced under all configurations, vessel traffic is expected to remain at similar levels as vessel traffic under the Project. Reduced navigational complexity combined with a smaller construction footprint and fewer offshore structures would result in the effects of			

Impact-Producing Factor	No Action Alternative	Alternative B (Proposed Action) Up to 100 WTGs	Alternative C (Habitat Alternative) 64 or 65 WTGs	Alternative D (Transit Alternative) 78 to 93 WTGs	Alternative E (Viewshed Alternative) 64 or 81 WTGs	Alternative F (Higher Capacity Turbine Alternative) 56 WTGs
	military and national security under the No Action Alternative would be **minor** adverse.	the effects of vessel traffic on military and national security uses under the Proposed Action would be **minor** adverse. The Proposed Action represents approximately 2% of typical vessel traffic in the GAA. Therefore, the Proposed Action would result in a **minor** adverse impact for vessel traffic on military and national security.	this IPF being the same or slightly reduced relative to those described for the Proposed Action. Therefore, impacts on military and national security would be **minor** adverse.			
Land-Based Radar						
Presence of structures	**Offshore:** Construction of 1,036 structures in the RI/MA WEA could lead to long-term, **minor** adverse impacts to radar systems. However, these structures would be sited at such a distance from existing and proposed land-based radar systems to minimize interference to most radar systems. The Final Massachusetts and Rhode Island Port Access Route Study (USCG 2020) concludes that general mitigation measures, such as properly trained radar operators, properly installed and adjusted vessel equipment, marked wind turbines, and the use of AIS all enable safe navigation with minimal loss of radar detection.	**Offshore:** Construction and installation and O&M of offshore Project components could result in impacts to land-based radar by introducing potential obstacles to radar coverage in the RI/MA WEA. The final Massachusetts and Rhode Island Port Access Route Study (USCG 2020) concludes that general mitigation measures, such as properly trained radar operators, properly installed and adjusted vessel equipment, marked wind turbines, and the use of AIS all enable safe navigation with minimal loss of radar detection. Therefore, the offshore Project components would result in **negligible** adverse impacts to land-based radar. The Proposed Action and past, present, and reasonably foreseeable activities would result in **minor** adverse impacts to land-based radar.	**Offshore:** Under Alternatives C through F, fewer WTG locations would be approved by BOEM. Because the impact would be slightly reduced regardless of configuration selected, all offshore impacts would be slightly reduced compared to the Proposed Action and would therefore be **negligible** to **minor** adverse. Radar line of sight backscatter effects may be altered or slightly reduced depending on which alternative configuration is selected, as all alternative configurations would reduce the number of WTGs. This could result in slightly reduced impacts to land-based radar at Falmouth ASR-8, Nantucket ASR-9, and the Providence ASR-9.			
Vessel traffic	**Offshore:** Construction and operational vessel traffic from future offshore wind development is expected to increase. This could impact land-based radar by increasing the number of vessels in the analysis area. BOEM assumes that all offshore wind developments in the GAA would use the developer agreed upon 1 × 1–nm spacing that aligns with other proposed adjacent offshore wind projects in the RI/MA WEA. This would allow more space for vessels to navigate and would help reduce potential interference on radar systems. As a result, the effects of vessel traffic on land-based radar under the No Action Alternative would be **minor** adverse.	**Offshore:** There would be increased construction and operational vessel and O&M traffic from the Proposed Action. This could impact land-based radar by increasing the number of vessels in the analysis area. The RWF's proposed 1 × 1–nm spacing would provide more space for vessels to navigate and would help reduce potential interference on radar systems. As a result, the effects of vessel traffic on land-based radar under the Proposed Action would be **negligible** adverse. Reasonably foreseeable activities are expected to also generate vessel traffic that would increase the number of vessels in the RI/MA WEA. EPMs would reduce the cumulative impacts of increased vessel traffic to a **minor** adverse level.	**Offshore:** Vessel traffic associated with Alternatives C through F may result in slightly reduced vessel traffic in the Lease Area and around ports given the smaller offshore footprint under the Habitat Alternative. Reduced navigational complexity combined with a smaller construction footprint and fewer offshore structures would result in the effects of this IPF being the same or slightly reduced relative to those described for the Proposed Action. Therefore, impacts on land-based radar would be **negligible** adverse for construction and O&M and **minor** adverse for cumulative impacts.			

Impact-Producing Factor	No Action Alternative	Alternative B (Proposed Action) Up to 100 WTGs	Alternative C (Habitat Alternative) 64 or 65 WTGs	Alternative D (Transit Alternative) 78 to 93 WTGs	Alternative E (Viewshed Alternative) 64 or 81 WTGs	Alternative F (Higher Capacity Turbine Alternative) 56 WTGs
Undersea Cables						
Presence of structures	**Offshore:** The future development of multiple wind energy projects could increase the complexity of undersea cable development by requiring routing around the facilities. Export cables are unlikely to preclude future undersea cable development because cable crossings can be protected using standard design techniques. Therefore, in the context of reasonably foreseeable environmental trends, the overall impacts from the presence of structures resulting from ongoing and planned actions are anticipated to be localized long term **negligible** because impacts can be avoided by routing design and standard cable protection techniques.	**Offshore:** The presence of the Project could preclude future submarine cable placement in the RWF and RWEC, although there are no future cables identified for location within this area. The impacts from foundation construction would be minor adverse while the installation of the RWECs would be **negligible** adverse. Once the foundations are constructed, impacts from foundation O&M and decommissioning would be **minor** adverse and O&M and decommissioning of RWECs would be **negligible** adverse. The overall impact from presence of structures on undersea cables would be **minor** adverse. BOEM estimates a cumulative total of up to 1,138 offshore WTGs and OSS foundations for the Proposed Action plus all other future offshore wind projects in the RI/MA WEA. While these structures could increase the routing complexity of undersea cables associated, cable crossing can be protected using standard cable protections. The impacts from foundation construction from reasonably foreseeable future actions would be **negligible** adverse because impacts can be avoided by routing design and standard cable protection techniques.	**Offshore:** Because the impact would be slightly reduced regardless of configuration selected, all offshore impacts under Alternatives C through F would be slightly reduced compared to the Proposed Action. The effects of this IPF would be the same or slightly reduced relative to those described for the Proposed Action and would therefore be **negligible to minor** adverse for construction and O&M and **negligible** adverse for cumulative impacts.			
Vessel traffic	**Offshore:** Increased vessel traffic due to construction and installation of future offshore wind activities could interfere with vessels used to install or maintain existing and future undersea cables, or lead to course changes of vessels used for undersea cable maintenance and installation and increased traffic along vessel transit routes. However, given the infrequency of required maintenance at any given location along a cable route, the effects of vessel traffic on undersea cables under the No Action Alternative would be **negligible** adverse.	**Offshore:** Increased vessel traffic due to construction and installation of the Proposed Action could interfere with vessels used to install or maintain existing and future undersea cables. Additionally, there would be increased risk for allisions with vessels used for construction and O&M of undersea cables. These effects are expected to be minimal and short term. Therefore, the effects of vessel traffic on undersea cables under the Proposed Action would be **negligible** adverse. The cumulative impact from vessel traffic on undersea cables would be **negligible** adverse.	**Offshore:** Vessel traffic associated with Alternatives C through F may result in slightly reduced vessel traffic in the Lease Area and around ports given the smaller offshore footprint. Reduced navigational complexity combined with a smaller construction footprint and fewer offshore structures would result in the effects of this IPF being the same or slightly reduced relative to those described for the Proposed Action. Therefore, impacts on undersea cables would be **negligible** adverse.			

3.17.2.2 Alternative B: Impacts of the Proposed Action on Aviation and Air Traffic

3.17.2.2.1 Construction and Installation

Offshore Activities and Facilities

Aviation and air traffic: The Proposed Action would result in an increase in air traffic related to construction and installation of offshore Project elements. Project construction would result in one to two helicopter flights to and from the Project area per day for construction of the foundations. Helicopters would also be used for additional crew transfers during construction activities. Estimated helicopter use for the RWF during the construction phase is estimated to be less than 200 helicopter trips and approximately 8,832 hours of flight time over the 2-year construction period (COP Appendix T [Tech Environmental 2021]). Based on national aviation statistics (FAA 2020), general aviation aircraft logged an estimated 792,266 hours of total flight in the FAA's New England Region in 2019. Extrapolating from nationwide statistics, helicopters would account for approximately 93,000 hours of the New England Region total. The Proposed Action would require a total estimated 8,832 hours of helicopter flight time for Project construction and installation, or approximately 4,416 flight hours per year, over the 2-year construction period of the Project. The GAA represents approximately 8% of the 160,000 square miles of airspace in the FAA New England Region. Applying this proportion, helicopter flights for Project construction and installation would represent a 63% increase in annual helicopter flight hours and a 7% increase in general aviation hours in the GAA. The effect determination is based on the 7% increase in general aviation hours in the GAA, as the increase in helicopter hours specifically would not have a direct impact on aviation and air traffic compared to the general overall increase in aircraft in the GAA. When estimation uncertainty is considered, the 7% increase in Project-related air traffic over the 2-year construction period represents a **minor** adverse effect on general aviation air traffic. A helicopter route plan would be developed to meet industry guidelines and best practices in accordance with FAA guidance. Additionally, all aviation operations, including flying routes and altitude, would be aligned with relevant stakeholders, such as the FAA. On this basis, the effects of Project-related aviation and air traffic on aviation and air traffic under the Proposed Action would be **minor** adverse.

Lighting: During construction and installation, WTGs would be marked with appropriate lighting to meet FAA warning guidelines and would be visible on the radar systems of low-flying aircrafts, similar to other large-scale sea surface activity. Therefore, impacts to aviation and air traffic would be **negligible** adverse.

Port utilization: Various ports would be improved to support the Proposed Action (see Section 3.14). These improvements would occur within the boundaries of existing port facilities, would be similar to existing activities at the existing ports, and would support state strategic plans and local land use goals for the development of waterfront infrastructure. The number of construction vessels would increase due to future offshore wind activities without the Proposed Action which could result in delays and congestion at ports which could lead to potential conflicts with air traffic due to increased activity in the vicinity of the airports listed in Section 3.17.1. Port improvements and construction activities in or near ports may require alteration of navigation patterns at nearby airports; however, port improvements are anticipated to occur under the No Action Alternative to support regional offshore wind energy industry development. Navigational hazards and collision risks at ports and in transit routes would be reduced as construction is completed. However, vessel traffic would also be spread among multiple ports to ensure that sufficient capacity exists at each port and in each waterway. Therefore, port utilization is expected to have a **negligible** adverse effect on aviation and air traffic.

Presence of structures: The Proposed Action would add up to 100 WTGs with maximum blade tip heights of up to 853 feet amsl. The addition of these structures would increase navigational complexity and could change aircraft navigation patterns for aircraft flying at low altitudes and for airports in the vicinity, increasing collision risks for some aircraft during the Proposed Action's operational timeframe. However, more than 90% of existing air traffic in the analysis area would occur at altitudes that would not be impacted by the presence of WTGs (BOEM 2021).

For the air traffic that occurs at altitudes that could be impacted by the presence of WTGs, the FAA conducts aeronautical studies to ensure that proposed structures do not have an effect on air navigation safety and the ability of aircraft to efficiently use navigable airspace. Proposed structures are considered as having an adverse effect if they exceed obstacle clearance surfaces.

An air traffic flow analysis for the Project was completed (Capitol Airspace Group 2020). WTGs at a height of 873 ASL could affect Visual Flight Rules (VFR) routes, requiring an increase to a Block Island State Airport (BID) instrument approach minimum altitude, Boston Consolidated (A90) Terminal Radar Approach Control (TRACON) minimum vectoring altitudes (MVAs), and Providence (PVD) TRACON MVAs.

However, historical air traffic data indicates that 873-foot ASL wind turbines would not affect any regularly used VFR routes. Additionally, historical air traffic data indicates that the required changes to the BID instrument approach procedure, A90 TRACON MVA sectors and PVD TRACON MVA sectors, should not affect a significant volume of operations. As a result of these findings, it possible that the FAA would be willing to increase the affected altitudes in order to accommodate wind development up to 873 feet ASL. These mitigation options are available and subject to FAA approval. Therefore, the effects of the presence of structures on aviation and air traffic under the Proposed Action would be **negligible** adverse.

Vessel traffic: Vessel traffic associated with the Proposed Action would result in increased vessel traffic in the Lease Area and around ports. Construction of offshore structures would noticeably increase navigational complexity along transit routes between ports and construction sites, and locally around ports due to increased vessel traffic. Increased vessel traffic is expected to have a **negligible** adverse effect on aviation and air traffic because vessel traffic would be spread throughout a large geographic area and would occur over a short period of time.

3.17.2.2.2 Operations and Maintenance and Decommissioning

Offshore Activities and Facilities

Aviation and air traffic: The Proposed Action would result in an increase in air traffic related to O&M and decommissioning of the Proposed Action. A hoist-equipped helicopter may be used to support O&M (vhb 2022). Table 3.5-5 in the COP provides a summary of O&M support vessels that are currently being considered to support Project O&M. The type and number of vessels and helicopters would vary over the operational lifetime of the Project.

During O&M, helicopters would be used to provide supplemental means of access when vessel access is not practical or desirable. Flights would be currently restricted to daylight operations when visibility is good. Helicopters would be used for two different purposes to support O&M:

- Helicopter hoist operations: An integrated helicopter hoist platform located on the roof of each WTG nacelle would provide access for O&M. SOVs and the OSSs may also be fitted with helicopter hoist platforms. The purpose of this effort is primarily for transport and transfer of technical personnel and equipment on to/from the WTGs via hoist to the nacelle but can also be conducted for transport and transfer of personnel and equipment to offshore installations that do not have a helideck. This is the most common means of access in the O&M phase and is typically used to perform minor repairs and restarts.
- Transport and transfer operations: Transport helicopter operations are flights from an onshore airport or heliport to an offshore installation or vessel with a helideck and back. Transfer helicopter operations are flights within the WEA from an offshore installation or vessel with a helideck to another, and back.

All aviation operations, including flying routes and altitude, would be aligned with relevant stakeholders, such as the FAA. It is anticipated that there would be up to 800 helicopter trips and a total flight time of up to 252 hours of flight time for O&M of the Project (Tech Environmental 2021). Based on national aviation statistics (FAA 2020), general aviation aircraft logged an estimated 792,266 hours of total flight in the FAA's New England Region in 2019. Extrapolating from nationwide statistics, helicopters would account for approximately 93,000 hours of the New England Region total. The Proposed Action would require an estimated 252 hours of helicopter flight time for project O&M, or approximately 8.4 flight hours per year, over the 35-year operating period of the Project. The GAA represents approximately 8% of the 160,000 square miles of airspace in the FAA New England Region. Applying this proportion, helicopter flights for Project O&M would represent a 0.1% increase in annual helicopter flight hours and a 0.01% increase in general aviation hours in the GAA. When estimation uncertainty is considered, this represents a **negligible** adverse effect on general aviation air traffic. On this basis, the effects of Project-related aviation and air traffic on aviation and air traffic under the Proposed Action would be **negligible** adverse.

<u>Light</u>: During O&M, WTGs would be marked with appropriate lighting to meet FAA warning guidelines and would be visible on the radar systems of low-flying aircrafts, similar to other large-scale sea surface activity. Decommissioning would have impacts similar to those during Project construction. Therefore, impacts to aviation and air traffic would be **negligible** adverse**.**

<u>Port utilization</u>: Various ports could be improved to support the Proposed Action (see Section 3.14). These improvements would likely occur within the boundaries of existing port facilities, similar to existing activities at the existing ports, and would support state strategic plans and local land use goals for the development of waterfront infrastructure. Navigational hazards and collision risks at ports and in transit routes would be reduced as construction is completed, and all navigation hazards and collision risks would be gradually eliminated during decommissioning as offshore WTGs are removed. However, vessel traffic would also be spread among multiple ports to ensure that sufficient capacity exists at each port and in each waterway. Therefore, port utilization is expected to have a **negligible** adverse effect on aviation and air traffic.

Presence of structures: The Proposed Action would add up to 100 WTGs and two OSSs having maximum blade tip and structure heights of up to 853 feet and 180 feet amsl, respectively. The addition of these structures would increase navigational complexity and could change aircraft navigation patterns for aircraft flying at low altitudes and for airports in the vicinity, increasing collision risks for some aircraft during the Proposed Action's operational time frame. However, more than 90% of existing air traffic in the analysis area would occur at altitudes that would not be impacted by the presence of WTGs (BOEM 2021). An air traffic flow analysis completed by Capitol Airspace found that it is possible that the FAA would be willing to increase the affected altitudes in order to accommodate wind development up to 873 feet above sea level (ASL) (Capitol Airspace Group 2020). Decommissioning would have impacts similar to those during Project construction. Therefore, the effects of the presence of structures on aviation and air traffic under the Proposed Action would be **negligible** adverse**.**

Vessel traffic: Vessel traffic associated with the Proposed Action would result in increased vessel traffic in the Lease Area and around ports. Addition of offshore structures would noticeably increase navigational complexity along transit routes between ports and construction sites, and locally around ports. Increased vessel traffic is expected to have a **negligible** adverse effect on aviation and air traffic because vessel traffic would be spread throughout a large geographic area and would be short term.

Onshore Activities and Facilities

Light: Operational lighting onshore would be limited to the OnSS and ICF, which would have minimal yard lighting and task lighting (see Section 3.14). This lighting is minimal and would not result in impacts to aviation and air traffic. Decommissioning would have impacts similar to those during Project construction. Therefore, the effects of light on aviation and air traffic under the Proposed Action would be **negligible** adverse**.**

Port utilization: Ports would be primarily used during construction and installation of the Proposed Action, as ports would be used for staging WTGs and for mobilizing construction work. Decommissioning would have impacts similar to those during Project construction. There would be no impacts to aviation and air traffic from O&M and decommissioning of the Proposed Action; therefore, impacts would be **negligible** adverse**.**

Presence of structures: The O&M of onshore structures to support the Proposed Action would not impact aviation and air traffic. This IPF would result in a **negligible** adverse impact because there would be no effect on this resource.

Vehicle traffic: Onshore vehicle traffic in and around ports and onshore facilities may increase as a result of O&M and decommissioning of the Proposed Action. Project-related vehicle traffic would not impact aviation and air traffic because these uses are generally spatially separate from vehicular traffic and occur in different locations. Therefore, this IPF would result in a **negligible** adverse impact because minimal increases in vehicle traffic would not impact aviation and air traffic.

3.17.2.2.3 Cumulative Impacts

Offshore Activities and Facilities

Aviation and air traffic: The Proposed Action would result in approximately 4,416 construction flight hours per year during construction and installation over a 2-year construction period, then the flight hours would significantly decrease to approximately 8.4 flight hours per year during O&M and decommissioning of the RWF. During construction and installation this results in a 7% increase in general aviation air traffic in the GAA and during O&M and decommissioning this results in a 0.01% increase in general aviation air traffic in the GAA. In total, there would be an average of 303 flight hours per year over 32 years (2-year construction period and up to 35-year operational period). This represents a 4% yearly increase in helicopter flight hours in the GAA and a 1% yearly increase in general aviation flight hours. Future offshore wind activities without the Proposed Action could also result in increased air traffic due to the use of helicopters and other aircraft during construction and installation, O&M, and decommissioning of future wind projects. While the exact increase in future Project-related flights is unknown, it is anticipated that reasonably foreseeable future wind activities would also result in increases in flight traffic similar in scale to the Proposed Action. The Proposed Action and reasonably foreseeable future wind projects would be required to engage the FAA in flight planning to avoid impacts to civilian, commercial, government, and military aviation operations. Therefore, the Proposed Action when combined with past, present, and other reasonably foreseeable project impacts would result in **negligible** adverse impacts on aviation and air traffic.

<u>Light:</u> The Proposed Action would add permanent lighting for up to 100 WTGs and 2 OSSs for the duration of the Project. BOEM estimates a maximum cumulative total of up to 1,138 offshore WTGs and OSS foundations for the Proposed Action plus all other future offshore wind projects in the GAA. All existing stationary structures would have navigation marking and lighting in accordance with FAA, USCG, and BOEM guidelines to minimize collision and allision risks. WTGs would also be visible on aircraft radar. Therefore, the cumulative impacts associated with the Proposed Action when combined with past, present, and reasonably foreseeable activities would be similar to those impacts described under the No Action Alternative and would have a **negligible** adverse impact on aviation and air traffic.

<u>Port utilization:</u> The Proposed Action combined with reasonably foreseeable future actions could result in a very minimal increase in vessel use at ports, most of which would be during construction and decommissioning of the Project. The number of construction vessels would increase due to both the Proposed Action and reasonably foreseeable future actions, which could result in delays and congestion at ports and lead to potential conflicts with air traffic due to increased activity in the vicinity of the airports listed in the Affected Environment. Port improvements and construction activities in or near ports may require alteration of navigation patterns at nearby airports. Navigational hazards and collision risks at ports and in transit routes would be reduced as construction is completed, and all navigation hazards and collision risks would be gradually eliminated during decommissioning as offshore WTGs are removed. However, vessel traffic would also be spread among multiple ports to ensure sufficient capacity exists at each port and in each waterway. Therefore, the Proposed Action when combined with past, present, and other reasonably foreseeable project impacts would result in a **negligible** adverse impact on aviation and air traffic.

<u>Presence of structures:</u> The Proposed Action structures represent a 10% increase over total estimated WTG and OSS foundations across the GAA under the No Action Alternative. BOEM estimates a cumulative total of up to 1,138 offshore WTGs and OSS foundations for the Proposed Action plus all other future offshore wind projects in the RI/MA WEA. WTGs could have maximum blade tip height of 1,171 feet amsl.

Addition of these structures would noticeably increase navigational complexity and change aircraft navigation patterns in the region around the leased areas offshore Massachusetts and Rhode Island, along transit routes between ports and construction sites, and locally around ports (see Port utilization). These changes could compress lower-altitude aviation activity into more limited airspace in these areas, leading to airspace conflicts or congestion, and increasing collision risks for low-flying aircraft. However, open airspace around the GAA would still be available over the open ocean, and ports used for offshore WTG construction would be planned and developed to accommodate tall structures.

Open airspace would continue to exist around all Lease Areas after the Proposed Action and reasonably foreseeable future offshore wind energy projects are built. BOEM assumes that offshore wind project operators would coordinate with aviation interests throughout the planning, construction and installation, O&M, and decommissioning process to avoid or minimize impacts on aviation activities and air traffic. Therefore, the Proposed Action when combined with past, present, and other reasonably foreseeable Project impacts would result in a **minor** adverse impact on aviation and air traffic.

Vessel traffic: Vessel traffic associated with the Proposed Action and reasonably foreseeable future actions would result in increased vessel traffic in the GAA. The impacts of increased vessel traffic are discussed above under Port Utilization and Presence of Structures. Vessel traffic would be spread throughout a large geographic area, and while construction time frames may overlap, it is anticipated that the increase in vessel traffic would not impact aviation and air traffic. Therefore, the Proposed Action when combined with past, present, and other reasonably foreseeable Project impacts would result in a **minor** adverse impact on aviation and air traffic.

Onshore Activities and Facilities

Lighting: It is not anticipated that any of the onshore Project components for the Proposed Action or reasonably foreseeable future actions would require FAA-compliant lighting. Therefore, the Proposed Action when combined with past, present, and other reasonably foreseeable Project impacts would result in **negligible** adverse impacts on aviation and air traffic from light.

Port utilization: WTG components located at staging ports could result in issuance of notices to airmen, causing some aircraft to reroute. WTG components would be in staging ports for brief periods. It is expected that reasonably foreseeable future actions would have similar port utilization impacts that account for construction and installation, O&M, and decommissioning of future actions. Therefore, cumulative impacts associated with the Project when combined with past, present, and reasonably foreseeable future activities would be **minor** adverse on aviation and air traffic.

Presence of structures: The construction and installation, O&M, and decommissioning of the Proposed Action and other reasonably foreseeable onshore structures would not contribute to cumulative impacts on aviation and aircraft because onshore structures are sited in industrial and commercial areas away from aviation uses. The presence of onshore structures would also be limited to O&M facilities, the OnSS, and ICFs that are similar in nature to surrounding land uses and would not create impacts on aviation uses. It is expected that reasonably foreseeable future actions would have similar structure impacts that account for construction and installation, O&M, and decommissioning of future actions. Therefore, cumulative impacts associated with the Project when combined with past, present, and reasonably foreseeable future activities would be **negligible** adverse on aviation and air traffic.

Vehicle traffic: Onshore vehicle traffic surrounding ports and onshore facilities may increase as a result of the Proposed Action, but it would not impact aviation and air traffic because these uses are spatially separate from vehicular traffic and occur in different locations. Additionally, it is anticipated that vehicular traffic would also increase at onshore wind facilities and port facilities as a result of reasonably foreseeable future actions. It is expected that vehicular traffic increases would be commensurate with the impacts expected for the Proposed Action in scale, intensity, and duration. Therefore, the Proposed Action combined with reasonably foreseeable future actions would result in a **negligible** adverse impact because minimal increases in vehicle traffic would not impact aviation and air traffic.

3.17.2.2.4 Conclusions

Project construction and installation, O&M, and decommissioning would affect ongoing aviation and air traffic occurring in the analysis area. Similar impacts from Project O&M would occur, although at a lesser extent and duration for aviation and air traffic. BOEM anticipates the impacts resulting from the Proposed Action alone would result in **negligible** adverse impacts on aviation and air traffic that would primarily be caused by installation of WTGs in the GAA due to potential changes in navigational patterns.

In the context of other reasonably foreseeable environmental trends and planned actions, the impacts under the Proposed Action resulting from individual IPFs range from **negligible** to **minor** adverse. Considering all the IPFs together, BOEM anticipates that the overall impacts associated with the Proposed Action when combined with past, present, and reasonably foreseeable activities would be **minor** adverse impacts for aviation and air traffic.

3.17.2.3 Alternative B: Impacts of the Proposed Action on Land-Based Radar

3.17.2.3.1 Construction and Installation

Offshore Activities and Facilities

Presence of structures: Construction and installation of offshore Project components could result in impacts to land-based radar by introducing potential obstacles to radar coverage in the RI/MA WEA. These impacts would be less than those identified for Project O&M and discussed in Section 3.17.2.3.2 Therefore, the construction and installation of offshore Project components would result in **negligible** adverse impacts to land-based radar.

Vessel traffic: There would be increased construction and operational vessel traffic from the Proposed Action, but the increase would not represent a substantial change to vessel traffic volume, which includes numerous ports and extensive marine traffic related to shipping, fishing, and recreation. As a result, the effects of vessel traffic on land-based radar under the Proposed Action would be **negligible** adverse.

3.17.2.3.2 Operations and Maintenance and Decommissioning

Offshore Activities and Facilities

Presence of structures: WTGs that are near or in direct line of sight to land-based radar systems can interfere with the radar signal by causing shadows or clutter in the received signal. Construction of 102 structures in the Lease Area could lead to impacts to land-based radar systems identified in Appendix S2 of the COP. The RLOS analysis (Westslope 2021) determined the following radar impacts by the presence of WTGs at a height of 873 amsl:

- For the Falmouth ASR-8, wind turbines in the northeastern two-thirds of the study area would be within the line of sight of and would interfere with this radar site at a blade-tip height of 873 feet above ground level (AGL).[2]
- For the Nantucket ASR-9, wind turbines in the eastern one-half of the study area would be within the line of sight of and would interfere with this radar site at a blade-tip height of 873 feet AGL.
- For the Providence ASR-9, wind turbines in the entire study area would be within the line of sight of and would interfere with this radar site at a blade-tip height of 873 feet AGL.
- For the North Truro ARSR-4 and the Riverhead ARSR-4, wind turbines in the study area would not be within the line of sight of and would not interfere with these radar sites at a blade-tip height of 873 feet AGL.
- The EWR LOS analysis for the Cape Cod AFS EWR shows that wind turbines in the majority of the study area will be within the line of sight of this radar site and could have a significant impact on this early warning radar at a blade-tip height of 873 feet AGL.

For the Falmouth ASR-8, Nantucket ASR-9, and the Providence ASR-9, without mitigation, the radar effects due to clutter could include a partial loss of primary target detection and a number of false primary targets over and in the immediate vicinity of wind turbines within the radar line of sight in the study area. Other radar effects include a partial loss of weather detection and false weather indications over and in the immediate vicinity of wind turbines within the line of sight in the study area.

The HF radar LOS analyses show the following:

- For the Amagansett HF radar, wind turbines in the western corners of the study area would be within the line of sight of this radar site at a blade-tip height of 873 feet AGL.
- For the Block Island Long Range HF radar, Camp Varnum HF radar, Horseneck Beach State Reservation HF radar, Long Point Wildlife Refuge HF radar, and the Martha’s Vineyard HF radar, wind turbines in the entire study area would be within the line of sight of these radar sites at a blade-tip height of 873 feet AGL.
- For the Block Island Standard Range HF radar, wind turbines in the western two-thirds of the study area would be within the line of sight of this radar site at a blade-tip height of 873 feet AGL.
- For the MVCO Meteorological Mast HF radar, wind turbines in the eastern one-fifth of the study area would be within the line of sight of this radar site at a blade-tip height of 873 feet AGL.
- For the Nantucket HF radar, wind turbines in the eastern one-third of the study area would be within the line of sight of this radar site at a blade-tip height of 873 feet AGL.
- For the Squibnocket Farms HF radar, wind turbines in the eastern one-fifth and along the northern edges of the study area would be within the line of sight of this radar site at a blade-tip height of 873 feet AGL.

[2] Height AGL used by Westslope (2021) is equivalent to height amsl as defined in Section 2.1.2.1, Table 2.1-1.

- For the Moriches HF radar, Nantucket Island HF radar, and the Nauset HF radar, wind turbines in the study area would not be within the line of sight of these radar sites at a blade-tip height of 873 feet AGL. Although wind turbines in the study area would not be within the line of sight of these radar sites, radar effects are still possible beyond line-of-sight due to the propagation of HF electromagnetic waves over the ocean surface.

Westslope (2021) concluded that, without mitigation, the Proposed Action could result in measurable effects on radar systems within their study area, including clutter in the vicinity of line-of-sight turbines and possibly in the vicinity of wind turbines beyond line-of-sight due to the propagation of HF electromagnetic waves over the ocean surface. These impacts could affect the following radar systems; the Amagansett HF radar, Block Island Long Range HF radar, Block Island Standard Range HF radar, Camp Varnum HF radar, Horseneck Beach State Reservation HF radar, Long Point Wildlife Refuge HF radar, Martha's Vineyard HF radar, MVCO Meteorological Mast HF radar, Nantucket HF radar, and the Squibnocket Farms HF radar.

The VOR screening analysis for the Martha's Vineyard VOR/DME, Providence VOR/DME, and the Sandy Point VOR/DME shows that the study area is greater than 8 nm from these navigational aid sites. Although possible, Revolution Wind does not anticipate that the FAA would have concerns with wind turbines in the study area at a blade-tip height of 873 feet AGL based on impacts to these navigational aid sites.

The NEXRAD weather radar screening analysis for the Boston WSR-88D and the Brookhaven WSR-88D shows that wind turbines in the study area would not be within the line of sight of and would not interfere with these radar sites at a blade-tip height of 873 feet AGL. The results also show that wind turbines in the study area at a blade-tip height of 873 feet AGL would fall within a NOAA green No Impact Zone for these radar sites.

The TDWR screening analysis for the Boston TDWR shows that the study area is beyond the instrumented range of this radar site. As such, no additional analysis was considered necessary for this radar site. In summary, there would be a **minor** adverse impact to air defense and homeland security radar and a **negligible** adverse impact on weather radar.

To address these concerns, BOEM would include terms and conditions in the COP approval requiring 30- to 60-day advanced notification to the North American Aerospace Defense Command ahead of Project completion and when the Project is complete and operational for radar management (RAM) scheduling, funding of RAM execution, and curtailment for national security or defense purposes, as described in the leasing agreement. Any other impacts on radar systems are anticipated to be mitigated by overlapping coverage and radar optimization. The FAA would evaluate potential impacts on radar systems, as well as mitigation measures, when Revolution Wind refiles Form 7460-1 for individual WTGs located within U.S. territorial waters. Revolution Wind's marine coordinator would remain on duty for the life of the Proposed Action to liaise with military, national security, civilian, and private interests to reduce potential radar conflicts. BOEM's (2020) study of radar interference concludes that HF SeaSonde radars, which monitor ocean currents, follow oil spills, and track powered and adrift vessels, are the most heavily impacted radar by offshore wind projects because WTGs create a phenomenon in which turbine echo is processed by these radar as current echo, resulting in interference with ocean current measurements. General mitigation measures determined by BOEM (2020) to be effective for HF radar include event-based operational changes and modification of some land-based radar. Event-based operational change may include wind farm curtailment agreements for BOEM lease areas that would cease wind farm operations when HF radar efficiency is essential, such as in the event of a severe hurricane/tropical storm or a large oil spill. BOEM is also working on developing a land-based HF radar software upgrade (BOEM 2020).

The Proposed Action includes 1 × 1–nm WTG spacing that reduces, but does not eliminate, navigational complexity and space use conflicts during the operation phases of the Project. Navigational complexity in the area would remain constant during simultaneous operations and would decrease as the Project is decommissioned and structures are removed. The final Massachusetts and Rhode Island Port Access Route Study (USCG 2020) concludes that general mitigation measures, such as properly trained radar operators, properly installed and adjusted vessel equipment, marked wind turbines, and the use of AIS all enable safe navigation with minimal loss of radar detection. Following the layout recommendations in the final Massachusetts and Rhode Island Port Access Route Study (USCG 2020) would improve safety, but it would not completely remove the risk of allisions or collisions with WTGs during SAR operations (of people or marine mammals), particularly in challenging weather or visibility conditions. Therefore, the effects of the presence of offshore structures on land-based radar under the Proposed Action would be **negligible** adverse**.**

<u>Vessel traffic:</u> Operational vessel traffic from the Proposed Action is expected to increase, although it would be less than during the construction and decommissioning phases. This could impact land-based radar by increasing the number of vessels in the analysis area. The Proposed Action includes 1 × 1–nm WTG spacing that allows more space for vessels to navigate and would help reduce potential interference on radar systems. As a result, the effects of vessel traffic on land-based radar under the Proposed Action would be **negligible** adverse**.**

3.17.2.3.3 Cumulative Impacts

Offshore Activities and Facilities

<u>Presence of structures:</u> The Proposed Action would result in long-term negligible adverse impacts to land-based radar when compared to conditions under the No Action Alternative. These structures would increase the long-term risk of radar interference or clutter.

BOEM’s radar study (2020) suggests general mitigation measures, including event-based operational changes and modification of some land-based radar through software upgrades to reduce impacts. For vessel-based radar, the Final Massachusetts and Rhode Island Port Access Route Study (USCG 2020) concludes that general mitigation measures, such as properly trained radar operators, properly installed and adjusted vessel equipment, marked wind turbines, and the use of AIS, all enable safe navigation with minimal loss of radar detection. BOEM would include approval conditions in the COP regarding notification to North American Aerospace Defense Command of RAM scheduling, funding of RAM execution, and curtailment for national security or defense purposes, as needed.

Therefore, the Proposed Action and past, present, and reasonably foreseeable activities would result in **minor** adverse impacts to land-based radar.

<u>Vessel traffic:</u> The Project Action would result in an increase of offshore vessels during every phase of the Project. The increase in vessels in the analysis area would result in long-term impacts to land-based radar due to increased potential for radar interference or clutter. Reasonably foreseeable activities are

expected to also generate vessel traffic that would increase the number of vessels in the RI/MA WEA. Measures described under Presence of structures would reduce the cumulative impacts of increased vessel traffic to a **minor** adverse level when considering cumulative impacts associated with the Proposed Action when combined with past, present, and reasonably foreseeable activities.

3.17.2.3.4 Conclusions

Project construction and installation, O&M, and decommissioning would affect land-based radar occurring in the analysis area. Similar impacts from Project O&M would occur, although at a lesser extent and duration for some uses. BOEM anticipates the impacts on land-based radar resulting from the Proposed Action alone would be **minor** adverse, as the overall effect would be managed through event-based operational changes and radar equipment upgrades.

In the context of other reasonably foreseeable environmental trends and planned actions, the impacts under the Proposed Action resulting from individual IPFs would range from **negligible** to **minor** adverse. Considering all the IPFs together, BOEM anticipates that the overall cumulative impacts associated with the Proposed Action combined with past, present, and reasonably foreseeable activities, would be **moderate** adverse for land-based radar.

3.17.2.4 Alternative B: Impacts of the Proposed Action on Military and National Security (including Search and Rescue)

3.17.2.4.1 Construction and Installation

Offshore Activities and Facilities

<u>Anchoring and new cable emplacement/maintenance:</u> Anchoring and mooring activities would occur during offshore wind energy development within the analysis area as part of the Proposed Action. This would involve increased vessel traffic which could impact military and national security uses by increasing the number of vessels within the analysis area. The presence of construction vessels could cause military vessels to change course or otherwise alter operations and could increase demand for SAR. These impacts are expected to be limited to cable emplacement corridors. Cable laying vessels are expected to travel slowly, typically at speeds of less than 1 knot, resulting in a low risk of collision with other vessels. In addition, it is anticipated that the USCG would establish temporary 500-yard navigation safety zones around each WTG foundation and each cable laying vessel, further reducing risk of contact with other vessels. Therefore, the effects of anchoring and new cable emplacement and maintenance under the Proposed Action on military and national security would be **negligible** adverse**.**

<u>Aviation and aircraft traffic:</u> Construction and installation of the Proposed Action would result in a 7% increase in general aviation in the GAA. Please refer to Section 3.17.2.2.1 for analysis of the Project's construction and installation impacts. The effects of this IPF on military and national security under the Proposed Action would be **minor** adverse, as there would be increased air traffic that could increase navigational complexities for military aircraft in the GAA.

<u>Light:</u> The Proposed Action would result in an increase in temporary construction aviation warning lighting on WTGs offshore. All existing stationary structures would have navigation marking and lighting in accordance with FAA, USCG, and BOEM guidance to minimize allision risks. Implementation of navigational lighting and marking per FAA and BOEM requirements and guidelines would further reduce

the risk of military aircraft collisions. This would result in a general increase of lights in the analysis area, which could have **minor** adverse impacts on military and national security by increasing the amount of light in the geographical analysis area.

Presence of structures: Access by military vessels to the RWF and RWEC would be limited during installation; however, USCG air- and waterborne SAR activities would still occur as needed. The addition of up to 100 WTGs, two OSSs, and two RWECs would increase the risk of allisions for military vessels for up to 35 years during Project operations, particularly in bad weather or low visibility. Military vessel traffic within the RI/MA WEA has historically been relatively low (four vessels recorded in 2016 and 2017), and deep-draft military vessels are not anticipated to navigate outside navigation channels unless necessary for SAR operations (BOEM 2021). Additionally, construction of the Proposed Action could attract recreational fishing or sightseeing vessels, which would add to the number of vessels operating in the area to complete construction of these Project elements. The presence of construction-related vessels and additional recreational vessels would add to conflict or collision risks for military and national security vessels and could increase demand for SAR operations. *The Areas Offshore of Massachusetts and Rhode Island Port Access Route Study* (USCG 2020) examined potential navigation SAR issues associated with anticipated offshore wind development in the RI/MA WEA. The USCG report concluded that a wind turbine array that follows a standard and uniform grid pattern with three lines of orientation and standard spaces, as proposed for the Project, would maintain the Coast Guard's ability to conduct SAR operations within the Lease Area (USCG 2020). BOEM (2020) acknowledges, however, that some SAR operations are aided by land-based radar vessel tracking, as well as wind and current tracking to extrapolate disabled vessel distance and direction, which can be inhibited by the presence of WTGs, and suggests mitigation related to radar equipment and event-based operational changes to counteract these effects. The navigational safety risk assessment found there are an average of 1.5 missions expected per year in the Lease Area (DNV GL Energy USA 2020). Therefore, it is anticipated that the presence of Project-related structures would impact some future USCG SAR missions. The presence of offshore wind infrastructure could require adjusting the operational parameters for such missions; however, the impact is anticipated to be minimal based on the uniform spacing of structures for waterborne SAR and other vessel maneuverability and mitigation for land-based radar.

Construction of the Proposed Action would necessitate use of stationary lift vessels within the RWEC, cranes in ports during construction, and FAA-regulated structures temporarily in transit routes between port and the WEA, increasing navigational complexity and changing navigational patterns for vessels and aircraft operating in the area around the WEA during construction and operations. Increased navigational complexity would increase the risk of collisions and allisions for military and national security vessels or aircraft within the WEA, and could increase demand for SAR. Structures would be marked as a navigational hazard per FAA, BOEM, and USCG requirements, and risk would be consistent within the 35-year operational period. It is anticipated that the USCG would establish temporary 500-yard (457-meter) navigation safety zones around each WTG foundation and each installation vessel, reducing risk of contact with other vessels The Project's 1 × 1–nm spacing reduces some of the risk of collisions and allisions. Based on the above impacts, the Project would have **minor** to **moderate** adverse impacts on military operations, including SAR, and national security due to the presence of structures.

Vessel traffic: There would be increased construction and operational vessel traffic from the Proposed Action. This could impact military and national security uses by increasing the number of vessels in the analysis area. The RWF's proposed 1 × 1–nm spacing would result in sufficient space between foundations for vessels to navigate. UCSG establishment of temporary safety zones around cable laying vessels and foundation construction sites would further minimize the potential for construction vessel conflicts with military vessels. As a result, the effects of vessel traffic on military and national security uses under the Proposed Action would be **minor** adverse**.**

3.17.2.4.2 Operations and Maintenance and Decommissioning

Offshore Activities and Facilities

Anchoring and new cable emplacement/maintenance: Anchoring and mooring activities would occur during offshore wind energy O&M and decommissioning within the analysis area as part of the Proposed Action. This would involve increased vessel traffic which could impact military and national security uses by increasing the number of vessels within the analysis area. However, the impacts are expected to be small and infrequent during O&M and decommissioning of offshore Project elements. Therefore, the effects of anchoring and new cable emplacement/maintenance under the Proposed Action on military and national security would be **negligible** adverse.

Aviation and aircraft traffic: O&M of the Proposed Action would result in a 0.01% increase in annual general aviation traffic in the GAA. Please refer to Section 3.17.2.2.2 for analysis of the Project's O&M impacts. The increase in vessel traffic associated with Project O&M could result in an increased demand for SAR, and increased military aircraft traffic in and around the RWF. Therefore, the effects of this IPF on military and national security activities under the Proposed Action, including SAR, would be **negligible** adverse.

Light: The O&M and decommissioning of the Proposed Action would result in an increase in permanent lighting on WTGs offshore until decommissioning is complete. All existing stationary structures would have navigation marking and lighting in accordance with FAA, USCG, and BOEM guidance to minimize collision risks. This would result in a general increase of lights in the analysis area, which could have a small impact on military and national security. The addition of permanent lighting would be an ongoing impact; therefore, the effects of light on military and national security under the Proposed Action would be **minor** adverse.

Presence of structures: The addition of up to 100 WTGs and up to two RWECs would increase risk of allisions for military vessels for up to 35 years during Project operations, particularly in bad weather or low visibility. Military traffic within the RI/MA WEA has historically been relatively low (four vessels recorded in 2016 and 2017), and deep-draft military vessels are not anticipated to navigate outside navigation channels unless necessary for SAR operations (BOEM 2021). Additionally, the Proposed Action could create an artificial reef effect until decommissioning is complete, attracting species of interest to recreational fishing or sightseeing, and attracting additional recreational fishing and sightseeing vessels that would be additive to existing vessel traffic in the area. The presence of additional recreational vessels would add to conflict or collision risks for military and national security vessels and could increase demand for SAR operations. Therefore, the Project would have **minor** adverse impacts on military operations and national security.

Vessel traffic: There would be increased operational vessel traffic from the Proposed Action. This could impact military and national security uses by increasing the number of vessels in the analysis area. The

RWF's proposed 1 × 1–nm spacing would result in more space for vessels to navigate and would help reduce conflicts with military vessels. As a result, the effects of vessel traffic on military and national security uses under the Proposed Action would be **minor** adverse**.**

3.17.2.4.3 Cumulative Impacts

Offshore Activities and Facilities

Anchoring and new cable emplacement/maintenance: Up to 19,526 acres could be affected by anchoring and mooring activities and cable installation during offshore wind energy development within the analysis area as part of the Proposed Action and other reasonably foreseeable future actions. This offshore energy facility construction of new cable emplacement and maintenance of cables would involve increased vessel traffic, which could impact military and national security uses by increasing the number of vessels within the analysis area. Increased vessel traffic due to anchoring and cable maintenance of wind facilities could lead to course changes of military vessels, thereby increasing navigational complexity and risk of collisions. However, these impacts are expected to be limited to cable emplacement corridors which would result in contact with cable emplacement and maintenance vessels of expected from the Proposed Action and future offshore wind activities. Therefore, the cumulative effects of anchoring and new cable emplacement and maintenance would be a **minor** adverse impact on military and national security.

Aviation and aircraft traffic: The Proposed Action would result in a measurable increase in general aviation traffic in the GAA during construction and installation, as well as decommissioning, which is expected to be similar in aviation traffic volumes and construction and installation. The Proposed Action would result in a negligible effect on aviation traffic during O&M of the RWF. Other planned and potential future offshore wind projects could also result in increased air traffic due to the use of helicopters and other aircraft during construction and installation, O&M, and decommissioning. While the aviation requirements of other reasonably foreseeable offshore wind activities are unknown, it is anticipated that the aviation requirements for construction and O&M of these projects would be similar to those for the Proposed Action. Construction of these projects may occur concurrently between now and 2030 and, with a conservative 7% increase in aircraft traffic for all aircraft types in the GAA, the cumulative increase in air traffic during the construction period would be additive. Once projects are operational, cumulative O&M air traffic would likely result in a 0.1% increase in aviation traffic for all aircraft. The Proposed Action and reasonably foreseeable future wind projects would be required to engage the FAA in flight planning to avoid impacts to civilian, commercial, government, and military aviation operations. Therefore, the Proposed Action when combined with past, present, and other reasonably foreseeable project impacts would result in **minor** adverse impacts on military and national security.

Light: The Proposed Action would result in an increase in permanent aviation warning lighting on WTGs offshore. All existing stationary structures would have navigation marking and lighting in accordance with FAA, USCG, and BOEM guidance to minimize collision risks and optimize aviation safety. This would result in a general increase of lighting in the GAA, adding to vessel, navigation, onshore housing, and port lighting, which could impact military and national security uses. The Project, in combination with other reasonably foreseeable future actions, could result in the addition of up to 1,138 lighted structures in the analysis area. Therefore, because Project activities combined with reasonably foreseeable activities would result in an increase in lighted structures offshore, the cumulative impacts of light on military and national security would be **minor** adverse.

<u>Presence of structures and vessel traffic:</u> The Proposed Action would require approximately 970 construction vessel trips per construction day over the 2-year construction period. This vessel activity would increase the risk of collisions, allisions, and spills. However, the Proposed Action represents approximately 2% of typical vessel traffic in the GAA. Therefore, the Proposed Action would result in **negligible** adverse impacts to military and national security uses.

BOEM estimates a peak of 380 vessels due to offshore wind project construction over a 10-year time frame. Although the number of construction vessels would represent a large portion of the traffic in the region, most vessels would remain in the Maximum Work Area, with fewer vessels transporting materials back and forth from ports. With multiple offshore wind projects under construction, traffic would also be spread among multiple ports to ensure that sufficient capacity exists at each port and in each waterway. Additionally, BOEM also anticipates that coordination with military and national security interests would be ongoing during construction and installation, O&M, and decommissioning activity.

The Proposed Action would result in noticeable impacts to military and national security through the installation and operation of up to 100 WTGs and two OSSs, along with stationary lift vessels and cranes during construction, to conditions under the No Action Alternative, for a total of 1,138 structures within the GAA. The Proposed Action structures represents a 10% increase over total estimated WTG and OSS foundations across the GAA under the No Action Alternative.

Project structures are likely to generate artificial reef effects that lead to increased abundance of commercially and recreationally desirable fish and shellfish within wind farm boundaries. This could in turn lead to an increase in commercial and recreational vessel traffic and activity in and around wind farms. Increased vessel traffic and presence of structures would therefore contribute to an increase the short-term and long-term collision and allision risks for military and national security vessels, as well as search and rescue vessels. However, deep-draft military vessels are not anticipated to transit outside navigation channels unless needed for search and rescue. Potential allision risks if these vessels lost power would be minimized through the Proposed Action’s 1 ×1–nm WTG spacing. BOEM also anticipates that coordination with military and national security interests would be ongoing during construction and installation, O&M, and decommissioning.

Changing navigation patterns could also concentrate vessels within and around the outsides of the RI and MA Lease Areas, potentially causing space use conflicts in these areas or reducing the effectiveness of SAR operations. While the addition of Project structures and associated construction vessels would also increase navigational complexity or alter navigation patterns for military and national security aircraft operating in the region, Project structures would be marked as a navigational hazard per FAA, BOEM, and USCG guidelines and WTGs would be visible on military and national security vessel and aircraft radar. The Proposed Action would implement a 1 × 1–nm spacing, consistent with all other projects in the RI/MA WEA.

Therefore, the cumulative impacts associated with the Proposed Action when combined with past, present, and reasonably foreseeable activities would consist predominately of impacts described under the No Action Alternative, which would be **moderate** adverse for presence of structures and **minor** adverse for vessel traffic on military and national security.

3.17.2.4.4 Conclusions

Project construction and installation, O&M, and decommissioning would affect ongoing military uses in the analysis area. Similar impacts from Project O&M would occur, although at a lesser extent and duration for some uses. BOEM anticipates that the impacts resulting from the Proposed Action alone that range from interference with ongoing military and national security activities to an expected increase in demand for SAR would range from negligible to moderate adverse. Therefore, BOEM expects the overall impact on military and national security from the Proposed Action alone to be **minor** adverse.

In the context of other reasonably foreseeable environmental trends and planned actions, the impacts under the Proposed Action resulting from individual IPFs would range from **negligible** adverse to **moderate** adverse. Considering all the IPFs together, BOEM anticipates that the overall impacts associated with the Proposed Action when combined with past, present, and reasonably foreseeable activities would be **moderate** adverse for military uses.

3.17.2.5 Alternative B: Impacts of the Proposed Action on Scientific Research and Surveys (see section in main EIS)

3.17.2.6 Alternative B: Impacts of the Proposed Action on Undersea Cables

3.17.2.6.1 Construction and Installation

Offshore Activities and Facilities

Presence of structures: Up to 100 WTGs, two OSS foundations, and two RWECs would be installed as part of the Proposed Action. The RWEC would cross up to seven identified subsea assets within the installation corridor, including three telecommunications cables.

The presence of the Project could preclude future submarine cable placement in the RWF and RWEC, although there are no future cables identified for location within this area. The presence of the RWF would likely require routing of future undersea cables around the Lease Area. Cable crossings of the RWEC would necessarily include mapping and installation of cable protection at the crossing location, standard design techniques for undersea cable installation. The impacts from foundation construction would be **minor** adverse while the installation of the RWECs would be **negligible** adverse. The overall impact from presence of structures on undersea cables would be **minor** adverse.

Vessel traffic: Increased vessel traffic due to construction and installation of the Proposed Action could interfere with vessels used to install or maintain existing and future undersea cables. Increased construction vessel traffic due to Project construction could lead to course changes of vessels used for undersea cable maintenance and installation and increased traffic along vessel transit routes. Additionally, there would be increased risk for allisions with vessels used for construction of undersea cables. These effects during the construction and installation phase are expected to be minimal and short term. Therefore, the effects of vessel traffic on undersea cables under the Proposed Action would be **negligible** adverse.

3.17.2.6.2 Operations and Maintenance and Decommissioning

Offshore Activities and Facilities

Presence of structures: Up to 100 WTGs, two OSS foundations and two RWECs would be installed as part of the Proposed Action. The presence of the Project could preclude future submarine cable placement. O&M of the Project would be less likely to interfere with future undersea cable development than construction and decommissioning. OSS and WTG foundations would have a larger footprint compared to the RWECs, which are buried, and therefore would be more likely to preclude future undersea cable development. Once the foundations are constructed, impacts from foundation O&M and decommissioning would be **minor** adverse and O&M and decommissioning of RWECs would be **negligible** adverse. The overall impact from presence of structures on undersea cables is **minor** adverse.

Vessel traffic: Increased vessel traffic due to O&M and decommissioning of the Proposed Action could interfere with vessels used to install or maintain existing and future undersea cables. Additionally, there is increased risk for allisions with vessels used for undersea cable O&M. However, given the infrequency of required maintenance at any given location along a cable route, this risk is expected to be low. These effects during the construction and installation phase are expected to be minimal and short in duration. Therefore, the effects of vessel traffic on undersea cables under the Proposed Action would be **negligible** adverse.

3.17.2.6.3 Cumulative Impacts

Offshore Activities and Facilities

Presence of structures: The Proposed Action would result in long-term impacts to existing undersea cables through the installation of up to 100 WTGs and two OSSs to conditions under the No Action Alternative. BOEM estimates a cumulative total of up to 1,138 offshore WTGs and OSS foundations for the Proposed Action plus all other future offshore wind projects in the RI/MA WEA.

Construction of the foundations associated with the Proposed Action and reasonably foreseeable future actions could increase the complexity of undersea cable development by requiring routing around the facilities. Export cables are unlikely to preclude future undersea cable development because cable crossings can be protected using standard design techniques. Therefore, in context of reasonably foreseeable environmental trends, the overall impacts from the presence of structures resulting from the Proposed Action and planned actions are anticipated to be localized long term **negligible** because impacts can be avoided by routing design and standard cable protection techniques.

Vessel traffic: Vessel traffic related to construction and O&M of undersea cables is expected to increase if new undersea cables are constructed and as ongoing maintenance is required. Additionally, there would be increased vessel traffic due to the Proposed Action and reasonably foreseeable future actions. The risk of allision to cable maintenance vessels could increase as more offshore wind energy projects are constructed. However, given the infrequency of required maintenance at any given location along a cable route, this risk is expected to be low. Therefore, the cumulative impact from vessel traffic on undersea cables is **negligible** adverse.

3.17.2.6.4 Conclusions

Project construction and installation, O&M, and decommissioning would affect undersea cables occurring in the GAA. Similar impacts from Project O&M would occur, although at a lesser extent and duration for some uses. BOEM anticipates the impacts resulting from the Proposed Action alone would be **negligible**. Therefore, BOEM expects the overall impact on other uses from the Proposed Action alone to be **negligible** adverse for undersea cables.

In the context of other reasonably foreseeable environmental trends and planned actions, the impacts under the Proposed Action resulting from individual IPFs would be **negligible**. Considering all the IPFs together, BOEM anticipates that the overall impacts associated with the Proposed Action when combined with past, present, and reasonably foreseeable activities would be **negligible** adverse impacts for undersea cables.

3.17.2.7 Alternatives C, D, E, and F: Aviation and Air Traffic

Table 3.17-1 provides a summary of IPF findings by alternative.

3.17.2.7.1 Conclusions

Although Alternatives C through F would reduce the number of WTGs and their associated inter-array cables, which would have an associated reduction in associated vessel and equipment use and air emissions, BOEM expects that the impacts resulting from each alternative alone would be **negligible** adverse to the Proposed Action. The overall impacts of Alternatives C through F when combined with past, present, and reasonably foreseeable activities would therefore be the same as under the Proposed Action: **minor** adverse impacts for aviation and air traffic.

3.17.2.8 Alternatives C D, E, and F: Land-Based Radar

Table 3.17-1 provides a summary of IPF findings by alternative.

3.17.2.8.1 Conclusions

Although Alternatives C through F would reduce the number of WTGs and their associated inter-array cables, which would have an associated reduction in associated vessel and equipment use and air emissions, BOEM expects that the impacts resulting from each alternative alone would be the same as the Proposed Action: **minor** adverse. The overall impacts of Alternatives C through F when combined with past, present, and reasonably foreseeable activities would therefore be the same as under the Proposed Action: **moderate** adverse impacts for land-based radar.

3.17.2.9 Alternatives C, D, E, and F: Military and National Security (including Search and Rescue)

Table 3.17-1 provides a summary of IPF findings by alternative.

3.17.2.9.1 Conclusions

Although Alternatives C through F would reduce the number of WTGs and their associated inter-array cables, which would have an associated reduction in associated vessel and equipment use and air emissions, BOEM expects that the impacts resulting from each alternative alone would be similar to the Proposed Action: **minor** adverse. The overall impacts of Alternatives C through F when combined with past, present, and reasonably foreseeable activities would therefore be the same as under the Proposed Action: **moderate** adverse for military uses and national security.

3.17.2.10 Alternatives C, D, E, and F: Scientific Research and Surveys (see section in main EIS)

3.17.2.11 Alternatives C, D, E, and F: Undersea Cables

Table 3.17-1 provides a summary of IPF findings by alternative.

3.17.2.11.1 Conclusions

Although Alternatives C through F would reduce the number of WTGs and their associated inter-array cables, which would have an associated reduction in associated vessel and equipment use and air emissions, BOEM expects that the impacts resulting from each alternative alone would be the same as the Proposed Action: **negligible** adverse. The overall impacts of Alternatives C through F when combined with past, present, and reasonably foreseeable activities would therefore be the same as under the Proposed Action: **negligible** adverse for undersea cables.

3.17.2.12 Mitigation

Mitigation measures for other uses (land-based radar and military and national security) proposed by BOEM and other cooperating agencies are listed in Appendix F, Table F-2 and here in more detail in Table 3.17-2. Not every other uses category has proposed mitigation measures; aviation and air traffic and undersea cables do not.

Table 3.17-2. Proposed Mitigation Measures – Other Uses (land-based radar and military and national security)

Mitigation Measure	Description	Effect
Land-based Radar		
Operational mitigation for ARSR-4 and ASR-8/9 radar	Mitigation for ASR-8/9 radar: • Passive aircraft tracking using ADS-B or signal/transponder • Increasing aircraft altitude near radar • Sensitivity time control (range-dependent attenuation) • Range azimuth gating (ability to isolate/ignore signals from specific range-angle gates) • Track initiation inhibit, velocity editing, plot amplitude thresholding (limiting the amplitude of certain signals) Modification mitigations for ARSR-4 and ASR-8/9 systems include using the dual beams of the radar simultaneously and using in-fill radar. Additional conditions for COP approval to mitigate potential impacts on ASR-8/9 include notifying the North American Aerospace Defense Command 30 to 60 days ahead of Project completion and when the Project is complete and operational for Radar Adverse-impact Management	These measures would reduce the anticipated minor adverse impacts to air defense and homeland security radar systems.

Mitigation Measure	Description	Effect
	(RAM) scheduling, contributing funds toward execution of the RAM, and curtailment of operations for national security or defense purposes.	
Mitigation for oceanographic HF radar	WTG operators sharing real-time surface current telemetry, other oceanographic data, and wind turbine operational data with radar operators would serve to aid interference mitigation. Mitigation would also include a wind farm curtailment agreement. Additional modifications identified for oceanographic HF radar systems include signal processing enhancements and antenna modifications.	These measures would complement existing EPMs and further reduce anticipated negligible impacts to weather radar and minor adverse impacts on SAR activities.
Mitigation for NEXRAD weather radar systems	Research is underway for potential to mitigate weather radar using phased array radars to achieve a null in the antenna radiation pattern in the direction of the wind turbine. Additional mitigation includes a wind farm curtailment agreement.	This measure would further reduce anticipated negligible impacts on weather radar systems.
Military and National Security		
Fiber-optic sensing technology	Distributed fiber-optic sensing (DFOS) technology proposed for the wind energy project or associated transmission cables would be reviewed by the DOD to ensure that DFOS is not used to detect sensitive data from DOD activities, to conduct any other type of surveillance of U.S. government operations, or to otherwise pose a threat to national security.	This measure would reduce potential adverse impacts to military and national security.
WTG shut-down mechanism	Equip all WTG rotors (blade assemblies) with control mechanisms to enable remote shutdown of requested WTGs by the USCG. A formal shut-down procedure would be part of the standard operating procedures and periodically tested. Normally, USCG-ordered shutdowns would be limited to those WTGs in the immediate vicinity of an emergency and for as short a period as is safely practicable under the circumstances, as determined by the USCG.	This measure would reduce potential adverse impacts to military and national security.
Operational mitigation for ARSR-4 and ASR-8/9 radar	Mitigation for ASR-8/9 radar: • Passive aircraft tracking using ADS-B or signal/transponder • Increasing aircraft altitude near radar • Sensitivity time control (range-dependent attenuation) • Range azimuth gating (ability to isolate/ignore signals from specific range-angle gates) • Track initiation inhibit, velocity editing, plot amplitude thresholding (limiting the amplitude of certain signals) Modification mitigations for ARSR-4 and ASR-8/9 systems include using the dual beams of the radar simultaneously and using in-fill radar. Additional conditions for COP approval to mitigate potential impacts on ASR-8/9 include notifying North American Aerospace Defense Command 30 to 60 days ahead	These measures would reduce the anticipated minor adverse impacts to air defense and homeland security radar systems.

Mitigation Measure	Description	Effect
	of Project completion and when the Project is complete and operational for RAM scheduling, contributing funds toward execution of the RAM, and curtailment of operations for national security or defense purposes.	
Mitigation for oceanographic HF radar	Through data sharing from turbine operators of real-time surface current telemetry, other oceanographic data, and wind turbine operational data with radar operators into the public domain to aid interference mitigation. Mitigation would also include a wind farm curtailment agreement. Additional modifications identified for oceanographic high-frequency radar systems include signal processing enhancements and antenna modifications.	These measures would complement existing EPMs and further reduce anticipated negligible impacts to weather radar and minor adverse impacts on SAR activities.
Mitigation for NEXRAD weather radar systems	Research is underway for potential to mitigate weather radar using phased array radars to achieve a null in the antenna radiation pattern in the direction of the wind turbine. Additional mitigation includes a wind farm curtailment agreement.	This measure would further reduce anticipated negligible impacts on weather radar systems.

3.18 Recreation and Tourism

3.18.1 Description of the Affected Environment and Environmental Consequences of the No Action Alternative for Recreation and Tourism

Geographic analysis area: The GAA for recreation and tourism (Figure 3.18-1) comprises all Project components plus a 40-mile radius around the Lease Area. The area covers approximately 6,113 square miles of open ocean, 1,488 square miles of land, and over 1,008 miles of shoreline, and coincides with the Project's visual impact assessment (EDR 2021) to 1) address Project visibility from visually sensitive resources located within New York, Connecticut, Rhode Island, and Massachusetts and 2) encompass all locations where BOEM anticipates recreation impacts associated with Project construction and installation, O&M, and decommissioning.

Affected environment: Recreation and tourism play a major role in the leisure pursuits of local residents and the coastal economies of the states affected by the Project (see Section 3.9 and Section 3.11). NOAA collects economic data for six sectors dependent on the ocean and Great Lakes: living resources, marine construction, marine transportation, offshore mineral resources, ship and boat building, and tourism and recreation. Tourism and recreation statistics from NOAA's Economics: National Ocean Watch are good indicators of coastal and ocean tourism because they estimate the ocean-dependent portion of business for hotels and restaurants by including only those establishments located in shore-adjacent zip code areas, and they exclude all forms of sports and entertainment that are not ocean-related. A summary of economic data for counties and states that fall within the recreation and tourism analysis area is aggregated in Table 3.18-1. As of 2018, ocean economy sectors accounted for 3% to 22% of the total economy for affected counties and states. Tourism and recreation were the substantive sources of economic activity for most locations.

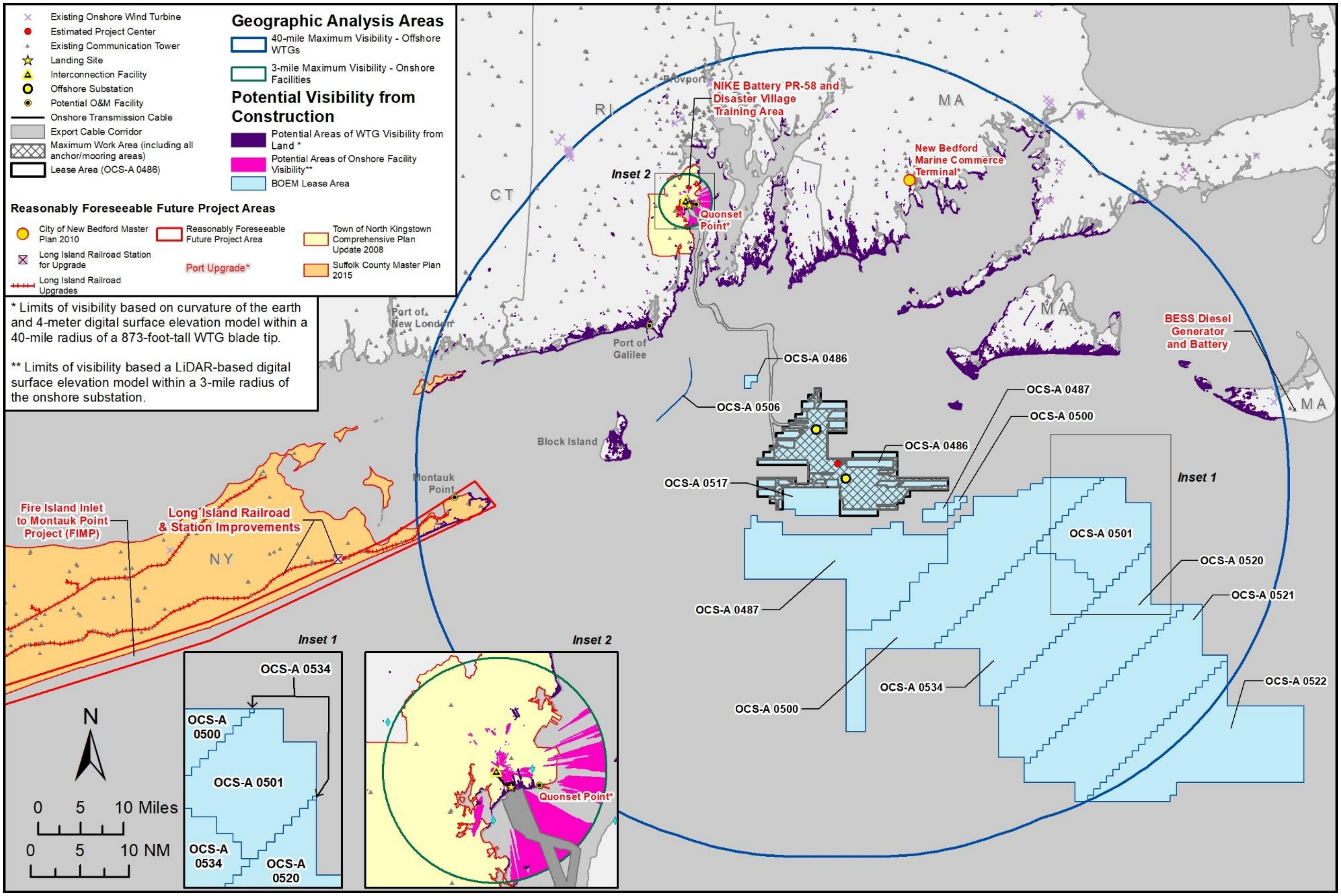

Figure 3.18-1. Geographic analysis area for recreation and tourism.

Table 3.18-1. Ocean Economies for Counties and States that Would be Directly or Indirectly Affected by the Project

Location	% of Total Economy	Number of Employed Residents for Tourism and Recreation (% of total residents employed in ocean economy)	Total Wages for Tourism and Recreation (% of total wages generated by ocean economy)	Total Gross Domestic Product for Tourism and Recreation (% of total gross domestic product generated by ocean economy)
Suffolk County, NY	6%	36,385 (87.9%)	921.1 million (70.1%)	1.9 billion (73.4%)
New London, CT	17%	7,397 (36.2%)	176.5 million (12.9%)	374.3 million (15.5%)
Washington, RI	21%	6,032 (53.5%)	145.2 million (31.6%)	327.6 million (27.6%)
Kent, RI	10%	7,338 (96.4%)	148.5 million (91.7%)	321.8 million (93.0%)
Providence, RI	6%	14,803 (92.1%)	326.3 million (84.8%)	700.0 million (87.9%)
Bristol, RI	17%	1,977 (86.8%)	46.5 million (76.8%)	96.1 million (72.6%)
Bristol, MA	3%	2,963 (48.9%)	55.0 million (19.1%)	105.8 million (16%)
Newport, RI	21%	6,976 (82.0%)	184.4 million (54.2%)	444.1 million (56.8%)
Plymouth, MA	5%	9,180 (87.5%)	203.8 million (71.2%)	400.9 million (71.3%)
Barnstable, MA	19%	17,028 (94.0%)	489.3 million (87.9%)	1.1 billion (87.0%)
Dukes, MA	16%	1,394 (97.5%)	52.9 million (96.1%)	120.1 million (96.9%)
Nantucket, MA	22%	1,668 (99.5%)	71.2 million (99.7%)	159.7 million (99.8%)

Source: NOAA (2020)

Notes: CT = Connecticut, MA = Massachusetts, NY = New York, RI = Rhode Island.

The analysis area for recreation and tourism supports a wide range of inland, shoreline or beach, and ocean-based recreation and tourist activities, including 16 water trails, more than 1,000 conservation areas, nearly 1,000 hiking trails, New Bedford Whaling National Historical Park, several hundred designated SCUBA diving areas, and 78 marinas (Northeast Ocean Data 2021). Recreational activities include beach-going, boating (for pleasure and competition), walking-hiking, swimming, surfing, metal detecting, horseback riding, camping, stand-up paddleboarding, cross-country skiing, kite sailing, and scenic-bird-nature viewing. The *Ocean State Outdoors Rhode Island's Comprehensive Outdoor Recreation Plan* (Rhode Island DEM 2019) identifies visiting coastal areas-beaches as one of the top three outdoor activities by Rhode Island residents. Likewise, Connecticut's statewide survey identifies beach activities as the top water-related recreation activity by residents (Center for Public Policy & Social Research 2017). Road or trail biking, birdwatching, and camping are also activities reported as displaying a relatively high degree of participation. Based on a broader study encompassing the northeast United States, the five most popular activities in the northeast region are beachgoing (61.9%), scenic enjoyment-sightseeing (50.2%), watching marine life (33.7%), photography (32.5%), and collecting non-living resources-beachcombing (27.4%) (Bloeser et al. 2015). The same study notes that surfing, stand-up paddleboarding, and triathlon typically occurred in nearshore bay-protected waters.

Locally, Blue Beach, a public beach, is approximately 500 feet west of the southwest corner of the Project's proposed 20-acre landfall envelope. Blue Beach is accessed via a trail located west of the Hayward Industries, Inc. building, which is just outside the landfall envelope. Compass Rose Beach, another public beach, is approximately 2,600 feet east of the southeast corner of the landfall envelope. The Martha's Vineyard Fast Ferry dock is directly east of Compass Rose Beach. The North Kingstown Golf Course is approximately 2,000 feet north of the northern edge of the landfall envelope and is separated by Roger Williams Way.

Boating in the analysis area includes ocean-going vessels down to small boats used by residents and tourists in sheltered waters. A 2012 survey of recreational boaters along the northeastern U.S. coast found that more than half (52.4%) of recreational boating occurred within 1 nm of the coastline (Starbuck and Lipsky 2013). In 2011, NOAA estimated that 93% of the 2011 recreational boating from Massachusetts occurred within 3 nm of shore (BOEM 2012). However, several long-distance sailboat races may pass through the offshore portions of analysis area, depending on the route selected for a particular year; these races include the Transatlantic Race, Marion to Bermuda Race, and Newport to Bermuda Race. Although these sailing events occur along the entire Long Island coastline, they are generally small (averaging less than 50 racing vessels). Larger sightseeing boats also travel to offshore locations where sightings of whales are more likely.

Recreational fishing along the shoreline and the pursuit of highly migratory species (HMS) such as tuna, shark, swordfish, and billfish are also popular recreational activities in the analysis area. In the nearby Vineyard Wind Lease Area, the recreational fishing effort for HMS occurs seasonally from June to October using a wide range of fishing methods, although mobile fishing methods predominate (Kneebone and Capizzano 2020). Coxes Ledge, The Fingers, and The Claw all support the highest level of recreational fishing for HMS (see Section 3.9 for additional discussion of recreational fishing activities and trends).

Although many of the above-listed publicly available recreation and tourism activities are free, local businesses also offer boat rentals and numerous recreation experiences such as private boat-cruise charters; canoe, kayak, and stand-up-paddleboard touring; whale watching; deep-sea fishing charters; and scuba diving in the analysis area. These tourism activities also support other local businesses, including non-ocean-related leisure, hotels, and restaurants.

Recreation and tourism in the GAA are noticeably higher in the spring, summer, and fall when the ambient air and water temperatures are comfortable (Parsons and Firestone 2018).

3.18.1.1 Future Offshore Wind Activities (without Proposed Action)

This section discloses potential recreation and tourism impacts associated with future offshore wind development. Analysis of impacts associated with ongoing activities and future non–offshore wind activities is provided in Appendix E1.

Offshore Activities and Facilities

Anchoring and new cable emplacement/maintenance: Construction of future projects would increase the number of anchored vessels and work platforms used for survey and construction purposes. Applying estimates developed by BOEM based on their 2019 study *National Environmental Policy Act Documentation for Impact-Producing Factors in the Offshore Wind Cumulative Impacts Scenario on the North Atlantic Outer Continental Shelf* (BOEM 2019), up to 2,160 acres of anchoring could occur under the No Action Alternative in the recreation and tourism GAA. The presence of anchored vessels could increase navigation complexity for recreational vessels. Increased turbidity from anchoring could also briefly alter the behavior of species important to recreational fishing (see Section 3.9) and sightseeing (primarily whales, but also dolphins and seals). However, most anchored construction-related vessels would be located within temporary safety zones (anticipated to be established and monitored by offshore wind developers). Likewise, most anchoring would occur outside the area most commonly used for recreational boating, which would prevent most conflicts for recreational uses. Anchoring activities would also be temporary and localized; therefore, construction-related anchoring impacts from future projects would be **minor** adverse. Anchoring impacts to fish species used for recreational fishing are addressed in Section 3.9.

Up to 10,148 acres of seafloor disturbance could occur from IAC and export cable installation within the recreation and tourism GAA (see Appendix E4, Table E4-1). As with anchoring, installation of offshore cables would temporarily increase navigation complexity for recreational vessels present around work areas and reduce recreational opportunities if individuals prefer to avoid the noise and disruption caused by installation. Cable installation could also have temporary impacts on individual fish and invertebrates of interest for recreational fishing due to dredging, turbulence, and disturbance; however, no population-level species impacts would occur. Once installed, buried cables typically have no maintenance unless a fault or failure occurs. Smaller vessel anchors would not penetrate to the typical target cable burial depth (4 to 6 feet), and recreational vessel anchoring is uncommon in water depths where offshore structures would be installed. However, scour protection for cables and foundations could hinder boat anchoring and result in gear entanglement or loss if recreational activity coincides with scour protection areas. If project-related seafloor hazards are not noted on charts, operators could lose anchors, leading to increased risks associated with drifting vessels that are not securely anchored. Therefore, new cable emplacement and maintenance would result in temporary to long-term **minor** adverse impacts.

Light: Construction of future planned offshore projects would require nighttime lighting on WTGs, vessels, and platforms that could be visible by onshore recreational users and tourists, as well as offshore boaters recreating at night or in low-light conditions. O&M of the estimated 936 WTGs in the GAA would require permanent aviation warning lights that could be visible from some beaches and coastlines and could impact recreation and tourism if recreation decisions are influenced by lighting. Field observations made from the mainland shoreline during WTG operations at the Block Island Wind Farm indicated that at nighttime and under clear skies, the turbine lights were visible with the naked eye up to 26.75 miles (23.2 nm) (HDR 2019). A University of Delaware study evaluating the impacts of visible offshore WTGs on beach use found that WTGs visible more than 15 miles from the viewer would have negligible adverse impacts on businesses dependent on recreation and tourism (Parsons and Firestone 2018). Likewise, a 2017 study on the impact of offshore wind facilities on vacation rental prices found that nighttime views of aviation hazard lighting (without ADLS) for WTGs close to shore (5 to 8 miles) would adversely impact the rental price of properties with ocean views (Lutzeyer et al. 2017). However, the study did not specifically address the relationship between lighting, nighttime views, and tourism for WTGs located farther from shore.

A 2013 BOEM study evaluated the impacts of WTG lighting on birds, bats, marine mammals, sea turtles, and fish. The study found that existing guidelines "appear to provide for the marking and lighting of [WTGs] that would pose minimal if any impacts on birds, bats, marine mammals, sea turtles or fish" (Orr et al. 2013). By extension, existing lighting guidelines or ADLS (if implemented) would not impact recreational fishing or wildlife viewing opportunities.

Lighting impacts would be most pronounced for views that can be currently characterized as undeveloped, where lighting from human infrastructure and activities is not dominant or even exists. However, less than 5% of the lighted WTG positions envisioned in the GAA would be within 15 miles from coastal locations. Therefore, visual impacts on recreation and tourism would be short term during construction and long term during O&M, with **negligible** to **moderate** adverse impacts, based on the observed distance and individual responses by recreationists and visitors to changes in the viewshed.

Noise: Construction noise from offshore activities from planned future projects such as pile driving, trenching, and construction-related vessels would intrude upon the natural sounds of the marine environment. Pile driving is the loudest aspect of most planned future projects. Most pile driving would occur far enough offshore that that work would be inaudible from onshore locations or from typical recreational fishing locations (within 1 mile of the coast). However, pile driving and other construction noise could cause some offshore boaters and recreational fishers to avoid areas of noise-generating activity, although the loudest noise would be within the temporary safety zones (with restricted recreational and tourism vessel access) anticipated to be established for each project by offshore wind developers. Additionally, because some fish species are sensitive to underwater sound, construction noise could cause fish to move away from the noise source, which could adversely affect recreational fishing opportunities near work areas. Construction noise could also contribute to impacts on marine mammals, with resulting impacts on marine sightseeing that relies on the presence of mammals, primarily whales. However, as noted in Section 3.15, no population-level marine mammal effects are anticipated.

Most of the anticipated offshore O&M noise from future projects would be from continuous WTG operations farther offshore. Sound pressure levels would be at or below ambient levels at relatively short distances from WTG foundations (Kraus et al. 2016). Field observations made during normal operations at the Block Island Wind Farm minimally exceeded ambient levels at 164 feet from the WTG base. These field observations also concluded that WTG operational noise from the Block Island Wind Farm was not detectable from shore and further suggested that as wind speeds increase (causing increased ambient noise), the associated increase in operational noise of the WTG becomes less detectable (HDR 2019). Therefore, noise from offshore activities would result in temporary to long-term **minor** adverse impacts.

Presence of structures: The placement and operation of up to 953 foundations (see Table E4-1 in Appendix E4) are proposed within the recreation and tourism GAA. Recreational impacts associated with in-water structures would include the risk of recreational vessel allision and collision, fishing gear entanglement, vessel damage or loss, increased navigation hazards, and visual impacts.

Offshore routes for recreational boaters, anglers, sailboat races, and sightseeing boats could require adjustment to avoid allision risks with in-water structures. Generally, the vessels more likely to allide with WTGs or OSSs would be smaller vessels capable of moving within and near wind installations. Examples include recreational fishing (especially HMS fishing), long-distance sailboat races, sightseeing boats, and large sailing vessels. Sailing vessels with tall masts that could be affected by in-water structures, like WTGs and associated platforms, could choose to avoid offshore in-water structures. However, the adverse impact of the future offshore wind structures on recreational boating would be limited by the distance offshore. As previously noted, a 2012 survey of recreational boaters along the northeastern United States coast found that the highest density of recreational vessels occurs within 1 nm of the coastline (Starbuck and Lipsky 2013). Likewise, a 2020 study of recreational boaters in the RI/MA WEA found that wind facilities are unlikely to have significant impacts on recreational boaters because those boaters prefer to use waters closer to the coast. Most recreational boaters from Rhode Island ports who choose to visit the RI/MA WEAs would likely keep their distance from new structures, and increased abundance of targeted fish species near offshore wind facilities would have beneficial impacts on recreational fishing (Dalton et al. 2020). Based on these findings, under the No Action Alternative, most recreational vessels would not interact with proposed WTGs and OSS(s). However, WTGs could also attract recreational boaters and sightseeing vessels. These conditions could increase the number of congregating vessels and increase collision or allision risks (see Section 3.16 for additional discussion of navigation impacts). The USCG would need to adjust their search and rescue planning and search patterns to allow aircraft to fly within the GAA, as described in greater detail in Section 3.17.

HMS fisheries are further offshore than most fisheries and therefore more likely to overlap with future offshore wind development. The greatest amount of recreational HMS fishing effort in southern New England from 2002 through 2018 occurred west of the RI/MA WEA (Kneebone and Capizzano 2020), although HMS fishing also occurred in specific locations within the RI/MA WEA, including The Dump, Coxes Ledge, The Fingers, and The Claw (see Section 3.9). Commonly used mobile methods for HMS angling such as trolling and drifting could be incompatible with the presence of WTGs and OSSs, depending upon weather conditions and specific techniques. For example, trolling could involve trailing many feet of lines and hooks behind the vessel and then following large pelagic fish once they are hooked, posing navigational and maneuverability challenges around WTGs. Scour protection used for in-water foundations would also increase risk of recreational fishing gear loss or damage by entanglement and present a hazard for anchoring (see new cable placement above). These concerns notwithstanding, new in-water structures could result in several long-term beneficial impacts including increased recreational fishing by introducing new aquatic habitats (see Section 3.9) and increased tourism by people interested in viewing the structures (see Section 3.18.2.2.2). New in-water structures could also create foraging opportunities for seals, small odontocetes, and sea turtles (see Sections 3.15 and 3.19), which could offer recreational sightseeing opportunities.

Visual impacts from the presence of vertical structures on the offshore horizon would create a visual contrast contrary to the horizontal plane of the ocean's water surface and the line at the visual horizon that separates the ocean from sky. Studies and surveys that have evaluated the impacts of offshore wind facilities on tourism found that established offshore wind facilities in Europe did not result in decreased tourist numbers, tourist experience, or tourist revenue, and that Block Island's WTGs provide excellent sites for fishing and shellfishing (Smythe et al. 2018). The proximity of WTGs to shore may be correlated to recreational experience. As noted in Parsons and Firestone (2018), different changes to beach experience occurred based on distance to visible WTGs. Reported trip loss (respondents who stated that they would visit a different beach without offshore wind) averaged 8% when wind projects were 12.5 miles (20 km) offshore, 6% when 15 miles (24.1 km) offshore, and 5% when 20 miles (32 km) offshore. Conversely, approximately 2.6% of respondents were more likely to visit a beach with visible offshore wind facilities at any distance. A 2019 survey of coastal recreation users in New Hampshire (Ferguson et al. 2020) also found that most users (77%) supported offshore wind development along the New Hampshire coast, 74% anticipated that offshore wind development would have a neutral to beneficial impact on their recreational activities, and 26% anticipated that offshore wind development would have an adverse impact (Ferguson et al. 2020).

Based on the currently available studies, portions of nearly all 936 WTGs associated with the No Action Alternative could be visible from shorelines (depending on vegetation, topography, weather, atmospheric conditions, and the viewers' visual acuity), of which up to 38 WTGs (fewer than 5%) would be within 15 miles of shore (see Section 3.20 for details). WTGs visible from some shoreline locations in the GAA would have adverse impacts on visual resources when discernable because of the introduction of industrial elements in previously undeveloped views. Visual impacts would be more pronounced in views lacking development and outside of heavy recreation use times (i.e., when crowds of beachgoers do not impact the visitor's experience of the natural elements of the landscape). Based on the research cited above, the impact of visible structures on recreation would be long term and **moderate** adverse but unlikely to impact shore-based or marine recreation and tourism in the GAA as a whole. Visual impacts to tribes that may be present or travel to the GAA for recreation or tourism purposes are disclosed in Section 3.10.

<u>Vessel traffic:</u> Future projects would generate increased nearshore and offshore vessel traffic, primarily during construction, along routes between ports and the offshore wind construction areas. Applying vessel activity estimates developed by BOEM based on their 2019 study *National Environmental Policy Act Documentation for Impact-Producing Factors in the Offshore Wind Cumulative Impacts Scenario on the North Atlantic Outer Continental Shelf* (BOEM 2019), vessel activity could peak in 2025 with as many as 276 vessels involved in the construction of reasonably foreseeable projects (see Section 3.16.1.1). Increased vessel traffic would require increased alertness on the part of recreational or tourist-related vessels and could result in minor delays or route adjustments, particularly if more than one future offshore wind facility is under construction at the same time. The likelihood of vessel collisions would increase as a result of the higher volumes of vessel traffic during construction. However, most of the moving construction-related vessels would be located within temporary safety zones (anticipated to be established and monitored by offshore wind developers), which would prevent most conflicts for recreational uses. These activities would also be temporary and localized. Although long-term increased traffic volumes from O&M of future projects would be low, they would add to existing in-water vessel traffic and therefore present **minor** long-term adverse impacts on recreational users.

Onshore Activities and Facilities

Anchoring and new cable emplacement/maintenance: No anchoring impacts would occur as a result of future onshore activities. However, onshore construction and installation of future wind facilities could affect recreation and tourism due to noise and activity at the landfall locations or along the onshore cable route if these locations intersect recreational or commercial uses. These **minor** adverse impacts would be unavoidable during construction but would be temporary and localized. No long-term cable impacts are anticipated because cables would be buried.

Light: Construction of some planned future onshore projects would require new visible structures or nighttime lighting on structures that could be visible by onshore recreational users and tourists. However, most onshore project components are anticipated to be in previously developed and lighted areas. Therefore, adverse effects of onshore lighting from construction would be short term and localized to discrete construction sites. Onshore O&M impacts from future projects would be variable based on project type (i.e., increased rail and road infrastructure use, increased port operational noise) but are anticipated to be long term with variable **minor** to **moderate** adverse impacts experienced based on the observed distance.

Noise: Construction noise from planned future projects onshore would be variable based on project type, but many projects would include one or more noise-generating activities such as earth moving, pile driving, trenching, jackhammering, and other similar large equipment operations. Recreational users could be subject to these construction noises anywhere future projects intersect public access areas, public recreational facilities, public roadways, or private and commercial facilities where tourism occurs (e.g., restaurants, shopping, and lodging establishments). Onshore construction noise from cable installation at the landfall locations, and inland if cable routes are near parkland, recreation areas, or other areas of public interest, would temporarily disturb the quiet enjoyment of the site (in locations where such quiet is an expected or typical condition). However, most of these onshore project components are anticipated to be in previously developed areas. Therefore, adverse effects of onshore noise from construction would be short term and localized to discrete construction sites. Onshore O&M impacts from future projects would be variable based on project type (i.e., increased rail and road infrastructure use, increased port operational noise) but are anticipated to be adverse and long term with variable **minor** to **moderate** adverse impacts experienced based on the distance to the noise source.

Vessel traffic: Future projects could increase onshore vehicle traffic or alter traffic patterns in a manner that inconveniences recreational users, primarily during construction near port facilities and on adjacent, existing roadways. Construction vehicles and construction areas would follow established safety guidelines that would prevent most conflicts for recreational uses. Impacts from onshore activities would be temporary and localized; therefore, construction impacts from future projects would not add to adverse impacts on recreational users. Although long-term increased traffic volumes from O&M activities of future projects would be relatively low, they would add to the existing onshore traffic and therefore present **minor**, localized long-term adverse impacts on recreational users.

3.18.1.2 Conclusions

Under the No Action Alternative, BOEM would not approve the COP; Project construction and installation, O&M, and decommissioning would not occur; and potential impacts on recreation and tourism associated with the Project would not occur. However, ongoing and future activities would have continuing short-term to long-term impacts on recreation and tourism, primarily due to the interruption of access and introduction of new offshore hazards, as well as new aquatic habitat and increased tourism/recreation opportunities.

BOEM anticipates that the range of individual IPF impacts for reasonably foreseeable offshore wind activities would be **negligible** to **moderate** adverse and **minor** beneficial, primarily due to the presence of offshore structures. As described in Appendix E1, BOEM anticipates that the range of individual IPF impacts for ongoing activities and reasonably foreseeable activities other than offshore wind would be **minor** to **moderate** adverse.

Considering all the IPFs together, BOEM anticipates that the overall impact associated with all reasonably foreseeable environmental trends and activities would result in **minor** adverse impacts on recreation and tourism because most adverse impacts could be avoided, would not disrupt normal or routine recreation and tourism functions, or would return to a condition with no measurable effects after activity ends.

3.18.2 Environmental Consequences

3.18.2.1 Relevant Design Parameters, Impact-Producing Factors, and Potential Variances in Impacts

This assessment analyzes the maximum-case scenario; however, there is the potential for variances in the proposed Project build-out, as defined in the PDE (see Appendix D). The Project design parameters that would influence the magnitude of the impacts on recreation and tourism consists of the number and type of WTGs installed. Impacts on recreational fishing and boating are based on the installation of 100 WTGs and two OSSs, for a total of 102 foundations in the GAA. If Revolution Wind were instead to install 59 12-MW WTGs, the maximum height of the blade tip for WTGs would be 873 feet above the surface, compared to 648 feet for the 8-MW WTGs. Because the WTGs would exceed 699 feet, FAA regulations require supplemental mid-tower lighting, in addition to lighting at the top of the nacelle (FAA 2018). The taller WTGs and additional lighting would result in greater visual impacts within the GAA. However, the 12-MW WTG option would reduce the number of WTGs and IAC; therefore, navigational complexity for offshore recreation users would be reduced compared to the 8-MW WTG option.

Revolution Wind has committed to implementing ADLS (as described in Appendix F) as a measure to reduce the duration of lighting impacts. Revolution Wind would also establish temporary safety zones around construction areas and work with the USCG to communicate these zones and other work areas to the boating public via local Notices to Mariners. These EPMs would be implemented across all alternatives; therefore, BOEM would not expect measurable potential variances in impacts across the alternatives.

See Appendix E1 for a summary of IPFs analyzed for recreation and tourism across all action alternatives. IPFs that are either not applicable to the resource or determined by BOEM to have a negligible adverse effect are excluded from Chapter 3 and provided in Appendix E1 Table E2-10.

Table 3.18-2 provides a summary of IPF findings carried forward for analysis in this section. Each alternative analysis discussion consists of the construction and installation phase, the O&M phase, the decommissioning phase, and the cumulative analysis. If these analyses are not substantially different, then they are presented as one discussion.

A detailed analysis of the Proposed Action is provided following the table. Detailed analysis of other considered action alternatives is also provided below the table if analysis indicates that the alternative(s) would result in substantially different impacts than the Proposed Action. Offshore and onshore IPFs are addressed separately in the analysis if appropriate for the resource; not all IPFs have both an offshore and onshore component. Where feasible, calculations for specific alternative impacts are provided in Appendix E4, to facilitate reader comparison across alternatives.

The Conclusion section within each alternative analysis discussion includes rationale for the effects determinations. All of the action alternatives would include both adverse and beneficial effects. Overall, these effects to recreation and tourism across all alternatives would be **minor** adverse because they would be small, and the resource would be expected to recover completely with no mitigating action required.

Table 3.18-2. Alternative Comparison Summary for Recreation and Tourism

Impact-Producing Factor	No Action Alternative	Alternative B (Proposed Action) up to 100 WTG	Alternative C (Habitat Alternative) 64–65 WTGs	Alternative D (Transit Alternative) 78–93 WTGs	Alternative E (Viewshed Alternative) 64–81 WTGs	Alternative F (Higher Capacity Turbine Alternative) 56 WTGs
Anchoring and new cable emplacement/ maintenance	**Offshore**: Most anchoring would occur outside the area most commonly used for recreational boating, which would prevent most conflicts for recreational uses. Anchoring activities would also be temporary and localized; therefore, construction-related anchoring impacts from future projects would be **minor** adverse. Smaller vessel anchors would not penetrate to the typical target cable burial depth (4 to 6 feet), and recreational vessel anchoring is uncommon in water depths where offshore structures would be installed. However, scour protection for cables and foundations could hinder boat anchoring and result in gear entanglement or loss if recreational activity coincides with scour protection areas. If project-related seafloor hazards are not noted on charts, operators could lose anchors, leading to increased risks associated with drifting vessels that are not securely anchored. Therefore, new cable emplacement and maintenance would result in temporary to long-term **minor** adverse impacts.	**Offshore**: Installation of offshore cables and anchoring would temporarily restrict recreation access within the cable routes. Revolution Wind would implement a comprehensive communication plan during offshore construction to inform all mariners, including commercial and recreational fishermen and recreational boaters, of construction activities and vessel movements. Temporary safety zones around each WTG site and each cable-laying vessel (anticipated to be established and monitored by Revolution Wind) would minimize potential conflicts for recreational uses. Potential O&M anchoring impacts would be similar to the construction phase, but reduced due to fewer anchored vessels. Therefore, potential changes in navigation routes due to Proposed Action would constitute a temporary, **minor** adverse impact. Cable installation could also affect fish and mammals of interest for recreational fishing and sightseeing through dredging and turbulence, although no population-level impacts are expected, resulting in short-term **minor** adverse impacts. Up to approximately 5,338 acres of anchoring and 14,157 acres of cabling seafloor disturbance could occur from ongoing and planned actions, including the Proposed Action, in the recreation and tourism GAA. Therefore, the Proposed Action when combined with past, present, and reasonably foreseeable activities would result in short-term and long-term **minor** adverse cumulative impacts on recreation and tourism.	**Offshore**: Alternatives C through F would reduce the number of WTG foundations and scour protection associated with the IAC. This could reduce risks associated with gear entanglement or loss if recreational activity coincides with scour protection areas. Reduced IAC installation could also negligibly decrease turbidity that could alter the behavior of species important to recreational fishing (see Section 3.9) and marine mammal sightseeing. During O&M, no impacts are anticipated because RWEC, IAC, and OSS transmission cable typically have no maintenance requirements unless a fault or failure occurs. Approximately 3,974 to 5,121 acres of anchoring and 14,157 acres of cabling seafloor disturbance could occur from ongoing and planned actions, including Alternatives C through F. Project-related construction anchorages would noticeably add to disturbances of marine species and their habitats important to recreational fishing and could require recreational and tourism vessels to navigate around moving and anchored construction-related vessels while in transit. The buried cabling would also present short-term navigational hazards. Therefore, Alternatives C through F when combined with past, present, and reasonably foreseeable activities would result in short-term and long-term **minor** adverse cumulative impacts on recreation and tourism.			
	Onshore: Onshore construction and installation of future wind facilities could affect recreation and tourism due to noise and activity at the landfall locations or along the onshore cable route if these locations intersect recreational or commercial uses. These **minor** adverse impacts would be unavoidable during construction but would be temporary and localized.	**Onshore:** Installation of onshore cables would be localized. No direct impacts to public parks, beaches, or other public recreational facilities would occur. Therefore, recreation and tourism impacts during construction would be temporary and **minor** adverse. No onshore cable maintenance would be required unless a fault or failure occurs. Therefore, cumulative, O&M, and decommissioning impacts would represent a **negligible** adverse impact on recreational users.	**Onshore:** Alternatives C through F would not impact onshore activities; therefore, impacts would be the same as those described for the Proposed Action: **negligible** adverse.			

Impact-Producing Factor	No Action Alternative	Alternative B (Proposed Action) up to 100 WTG	Alternative C (Habitat Alternative) 64–65 WTGs	Alternative D (Transit Alternative) 78–93 WTGs	Alternative E (Viewshed Alternative) 64–81 WTGs	Alternative F (Higher Capacity Turbine Alternative) 56 WTGs
Light	**Offshore:** Visual impacts on recreation and tourism would be short term during construction and long term during O&M, with **negligible to moderate** adverse impacts, based on the observed distance and individual responses by recreationists and visitors to changes in the viewshed.	**Offshore:** Visual impact assessment prepared for Revolution Wind (see COP Appendix U3 [EDR 2021]) determined that the Project would not likely be easily detectable when viewed from a distance of 20 miles or more and that only 3% of the land area within the visual study area would contain views of the Project. Therefore, visual impacts on recreation and tourism would be temporary during construction, with **negligible** to **moderate** adverse impacts, based on the observed distance. The Proposed Action's aviation warning lighting, when visible, would add a developed/industrial visual element to views that were previously characterized by dark, open ocean during O&M. Due to the limited duration and frequency of such events and the distance of WTGs from shore, however, visible aviation hazard lighting for the Proposed Action would result in a long-term intermittent **negligible** adverse impact on recreation and tourism. Given the distance from recreational viewers and atmospheric interference, lighting from the Proposed Action, when combined with past, present, and reasonably foreseeable projects, would result in long-term intermittent **minor** adverse cumulative impacts on recreation and tourism.	**Offshore:** Construction of offshore components would likely require less time for Alternatives C through F than anticipated for the Proposed Action, and could lead to reduced potential lighting impacts due to a smaller number of installed WTGs. Therefore, Alternatives C through F would have **negligible** to **moderate** adverse impacts. Alternatives C through F would also reduce nighttime O&M lighting as compared to the Proposed Action, due to required aviation hazard lighting of fewer WTGs, plus the two OSSs. Due to the limited duration and frequency of such events and the distance of WTGs from shore, however, visible aviation hazard lighting would still only result in a long-term negligible adverse impact on recreation and tourism. Offshore construction activities would add new WTGs and two OSSs to the No Action Alternative. Construction vessels would employ navigational safety lighting, and offshore structures would employ aviation and navigation hazard lighting. New lighting from Alternatives C through F would contribute a 7% to 10% increase to in-water lighting sources from past, present, and reasonably foreseeable future projects within the GAA by introducing built visual elements to views previously characterized by dark, open ocean. Collectively, only approximately 2% to 5% of the WTG positions envisioned in the GAA would be less than 15 miles from coastal locations for any given alternative. Given the distance from recreational viewers and atmospheric interference, lighting from Alternatives C through F, when combined with past, present, and reasonably foreseeable projects, would result in long-term intermittent **minor** adverse cumulative impacts on recreation and tourism.			
	Onshore: Construction of some planned future onshore projects would require new visible structures or nighttime lighting on structures that could be visible by onshore recreational users and tourists. Onshore O&M impacts from future projects would be variable based on project type) but are anticipated to be long term with variable **minor** to **moderate** adverse impacts experienced based on the observed distance.	**Onshore**: Light from onshore construction activities could temporarily adversely impact the recreation experience of users if present or traveling on roads near the landing site, onshore cable route, and proposed onshore facilities. However, as previously noted, no public parks, beaches, or other public recreational facilities are within or immediately adjacent to this onshore route, OnSS, or ICF. For nighttime construction work, downward-facing portable floodlights would be used in compliance with all safety and security and local government requirements. Therefore, for most locals and tourists, any adverse impacts would be temporary, **minor**, and inconvenient but would not cause a loss to their overall experience. Operational lighting for the OnSS and ICF would comply with Quonset Development Corporation lighting regulations and be mounted with the lamp horizontal to the ground (light facing straight down) or with a lamp tilt no more than 25 degrees from the horizon. As such, it is anticipated that the OnSS and ICF would result in long-term **negligible** adverse lighting impacts to the recreation and tourism activities in the GAA. Construction associated with the Proposed Action could add temporary **minor** adverse light impacts experienced by onshore recreational users near the landfall work area, onshore transmission cable route, or onshore facilities or from the aviation hazard lighting on the new WTGs. Therefore, the Proposed Action when combined with past, present, and reasonably foreseeable projects would result in temporary **minor** adverse cumulative impacts to onshore recreation and tourism.	**Onshore:** Alternatives C through F would not impact onshore activities; therefore, impacts would be the same as those described for the Proposed Action: **negligible** to **minor** and temporary to long term.			

Impact-Producing Factor	**No Action Alternative**	**Alternative B (Proposed Action) up to 100 WTG**	**Alternative C (Habitat Alternative) 64–65 WTGs**	**Alternative D (Transit Alternative) 78–93 WTGs**	**Alternative E (Viewshed Alternative) 64–81 WTGs**	**Alternative F (Higher Capacity Turbine Alternative) 56 WTGs**
Noise	**Offshore**: Pile driving is the loudest aspect of most planned future projects. Most pile driving would occur far enough offshore that that work would be inaudible from onshore locations or from typical recreational fishing locations (within 1 mile of the coast). However, pile driving and other construction noise could cause some offshore boaters and recreational fishers to avoid areas of noise-generating activity, although the loudest noise would be within the temporary safety zones (with restricted recreational and tourism vessel access) anticipated to be established for each project by offshore wind developers. Most of the anticipated offshore O&M noise from future projects would be from continuous WTG operations farther offshore. Field observations also concluded that WTG operational noise from the Block Island Wind Farm was not detectable from shore and further suggested that as wind speeds increase (causing increased ambient noise), the associated increase in operational noise of the WTG becomes less detectable (HDR 2019). Therefore, noise from offshore activities would result in temporary to long-term **minor** adverse impacts.	**Offshore**: Construction noise could result in impacts on recreation and tourism through displacement of species important to recreational fishing and sightseeing in and around construction areas, resulting in a short-term **moderate** adverse impact to fishing, shellfishing, or whale-watching activities. Offshore construction and onshore cable installation near the landfall area at Quonset Point in North Kingstown, Rhode Island, could have short-term **negligible** to **minor** adverse impacts on the recreational enjoyment of the marine and coastal environments. Offshore operational noise from the WTGs would be similar to the noise described for other projects under the No Action Alternative and would thus have long-term **minor** adverse impacts. Because of the distance from receptors, the Proposed Action when combined with past, present, and reasonably foreseeable activities would result in localized short-term **minor** to **moderate** adverse cumulative impacts on recreation and tourism due to construction activities, whereas noise from O&M activities would result in long-term **negligible** adverse cumulative impacts.	**Offshore**: Alternatives C through F would negligibly decrease noise associated with pile driving for WTGs as compared to the Proposed Action, resulting in short-term **moderate** adverse impacts. Operational noise sources and levels would also be similar to, but slightly lower than the Proposed Action, resulting in long-term **minor** adverse impacts. Construction activities would add noise from pile driving for foundations proposed under Alternatives C through F, and offshore dredging for the export and inter-array cabling to the ambient noise levels of the No Action Alternative. Noise from construction could lead to the displacement of fish in and around construction sites, leading to spatial competition, depending on migrating patterns. Recreational boaters and tourists would not be permitted to approach active construction zones and would therefore not be expected to experience noise impacts from offshore construction. Because of the distance from receptors, Alternatives C through F when combined with past, present, and reasonably foreseeable activities would result in localized, short-term **minor** to **moderate** adverse cumulative impacts on recreation and tourism due to construction activities, whereas noise from O&M activities would result in long-term **negligible** cumulative impacts.			
	Onshore: Construction noise from planned future projects onshore would be variable based on project type, but many projects would include one or more noise-generating activities such as earth moving, pile driving, trenching, jackhammering, and other similar large equipment operations. Onshore O&M impacts from future projects would be variable based on project type but are anticipated to be adverse and long term with variable **minor** to **moderate** adverse impacts experienced based on the distance to the noise source.	**Onshore**: Noise from onshore construction activities could temporarily adversely impact the recreation experience of users if present or traveling on roads near the landing site, onshore cable route, and proposed onshore facilities. However, as previously noted, no public parks, beaches, or other public recreational facilities are within or immediately adjacent to this onshore route, OnSS, or ICF. Therefore, for most locals and tourists, any adverse impacts would be temporary, **minor**, and inconvenient but would not cause a loss to their overall experience. Operations of onshore Project components (i.e., offshore to onshore transition joint bays, onshore transmission cable route, OnSS, and ICF) would have **negligible** adverse noise impacts intermittently over the life of the Project to onshore recreation and tourism because these components would only require periodic routine maintenance. As with lighting, construction activities would add noise from the construction of onshore facilities to the ambient noise levels of the No Action Alternative. Therefore, the Proposed Action when combined with past, present, and reasonably foreseeable projects would result in temporary **minor** adverse cumulative impacts to onshore recreation and tourism.	**Onshore**: Alternatives C through F would not impact onshore activities; therefore, impacts would be the same as those described for the Proposed Action: **negligible** to **minor** and temporary to long term.			

Impact-Producing Factor	**No Action Alternative**	**Alternative B (Proposed Action) up to 100 WTG**	**Alternative C (Habitat Alternative) 64–65 WTGs**	**Alternative D (Transit Alternative) 78–93 WTGs**	**Alternative E (Viewshed Alternative) 64–81 WTGs**	**Alternative F (Higher Capacity Turbine Alternative) 56 WTGs**
Presence of structures	**Offshore**: Recreational impacts associated with in-water structures would include the risk of recreational vessel allision and collision, fishing gear entanglement, vessel damage or loss, increased navigation hazards, and visual impacts: The impact of visible structures on recreation would be long term and **moderate** adverse but unlikely to impact shore-based or marine recreation and tourism in the GAA as a whole.	**Offshore**: Offshore structures would impact recreation and tourism through increased navigational complexity, risk of allision or collision, attraction of recreational vessels to offshore wind structures for fishing and sightseeing, increased risk of fishing gear loss or damage by entanglement due to scour or cable protection, and potential difficulties in anchoring over scour or cable protection. Revolution Wind would minimize these **minor** to **moderate** adverse impacts through the navigation- and fishing-related EPMs listed in Appendix F. Based on the duration of Project activity and observed distance, visual contrast associated with the Proposed Action could have a beneficial, adverse, or neutral impact on the quality of the recreation and tourism experience depending on the viewer's orientation, activity, and purpose for visiting the area. Additionally, construction of offshore Project components could elicit a long-term **minor** beneficial impact through an increase in curiosity, recreational fishing and diving activity. New structures related to the Proposed Action would noticeably increase navigational complexity; risks of structure allision; route adjustments for races, sightseeing, and fishing; loss and damage of fishing gear to scour and cable protection; viewshed changes; and difficulty anchoring over scour and cable protection. However, new in-water structures from the Proposed Action could benefit recreation and tourism by attracting recreational vessels to WTGs for fishing and sightseeing activities. Therefore, new in-water structures from the Proposed Action when combined with past, present, and reasonably foreseeable activities would result in short-term and long-term **minor** to **moderate** adverse and long-term **minor** beneficial cumulative impacts on recreation and tourism.	**Offshore**: Alternatives C through F would reduce the number of WTGs, potentially allowing for improved maneuverability for recreational vessels through the Lease Area. The Habitat Alternative could also negligibly reduce visual impacts as compared to the Proposed Action, depending on the observable distance and individual responses to a view of offshore wind farms (see Section 3.20 for details). Alternatives C through F would add foundations to the 953 foundations estimated for the No Action Alternative within the GAA. New structures would add to the long-term impacts on recreation and tourism throughout the life of the Project (up to 35 years, plus up to an additional 2 years for decommissioning) by increasing navigational complexity; risks of structure allision; route adjustments for races, sightseeing, and fishing; loss and damage of fishing gear to scour and cable protection; and difficulty anchoring over scour and cable protection. Based on visual simulations from onshore locations, some seaside locations could experience reduced recreational and tourism activity as a result of visible in-water structures, but the visibility of large offshore structures is not expected to impact shore-based recreation and tourism as a whole. New in-water structures could also benefit recreation and tourism by attracting recreational vessels to WTGs for fishing and sightseeing activities. Therefore, new in-water structures from the Proposed Action when combined with past, present, and reasonably foreseeable activities would result in short-term and long-term **minor** to **moderate** adverse and long-term **minor** beneficial cumulative impacts on recreation and tourism.			
	Onshore: Not applicable	**Onshore**: Inland residential/commercial areas and recreational sites would generally be screened from construction views due to the presence of existing development combined with forested areas (see COP Appendix U1). Therefore, any adverse impacts to overall recreator experience would be temporary and **minor** adverse impacts, but would not cause a loss to the overall recreator experience. The proposed OnSS and ICF would not be out of scale or character with the existing types of development currently present in the vicinity, such as the existing Davisville Substation or the structures at nearby Quonset Business Park. As such, it is anticipated that O&M of the OnSS and ICF would result in **negligible** adverse visual impacts to recreation and tourism activities in the GAA. New onshore structures would only result in **minor** adverse visual impacts experienced by recreational users due to the existing settings at these locations. When considered cumulatively with past, present, and reasonably foreseeable activities, the Proposed Action would result in temporary **negligible** to **minor** adverse cumulative visual impacts on recreation and tourism.	**Onshore:** Alternatives C through F would not impact onshore activities; therefore, impacts would be the same as those described for the Proposed Action: **negligible** to **minor** adverse and temporary to long term.			

Impact-Producing Factor	No Action Alternative	Alternative B (Proposed Action) up to 100 WTG	Alternative C (Habitat Alternative) 64–65 WTGs	Alternative D (Transit Alternative) 78–93 WTGs	Alternative E (Viewshed Alternative) 64–81 WTGs	Alternative F (Higher Capacity Turbine Alternative) 56 WTGs
Vessel traffic	**Offshore**: Future projects would generate increased nearshore and offshore vessel traffic, primarily during construction, along routes between ports and the offshore wind construction areas. Although long-term increased traffic volumes from O&M of future projects would be low, they would add to existing in-water vessel traffic and therefore present **minor** long-term adverse impacts on recreational users.	**Offshore**: Construction would result in as many as 61 construction vessels per construction day in 2023 and 2024 present at offshore work areas on a daily basis. However, the majority of recreational boating occurs within 1 nm of shore. Therefore, most recreational boaters in the GAA would experience a temporary **minor** adverse inconvenience from construction-related vessel traffic. The estimated low volume of O&M vessel traffic would not be anticipated to affect ongoing recreational use. O&M of the Proposed Action would therefore have **negligible** adverse impacts on onshore or offshore recreation and tourism. Project vessels would add to disturbances of marine species and their habitats important to recreational fishing and could require recreational and tourism vessels to navigate around moving construction-related vessels while in transit. Therefore, the Proposed Action when combined with past, present, and reasonably foreseeable activities would result in short-term and long-term **minor** adverse cumulative impacts on recreation and tourism.	**Offshore**: Construction of offshore components would likely require less time for Alternatives C through F than anticipated for the Proposed Action, and could lead to reduced potential navigational impacts for recreational users due to a smaller number of WTGs. Therefore, Alternatives C through F would have **negligible** to **minor** adverse impacts.			
	Onshore: Future projects could increase onshore vehicle traffic or alter traffic patterns in a manner that inconveniences recreational users, primarily during construction near port facilities and on adjacent, existing roadways. Although long-term increased traffic volumes from O&M activities of future projects would be relatively low, they would add to the existing onshore traffic and therefore present **minor**, localized long-term adverse impacts on recreational users.	**Onshore**: No public parks, beaches, or other public recreational facilities are immediately adjacent to the onshore route, OnSS, or ICF. Additionally, Revolution Wind would coordinate with local authorities during onshore construction to minimize local traffic impacts. Therefore, any adverse impacts to tourism or overall recreator experience would be temporary to long term and **minor** adverse.	**Onshore**: Alternatives C through F would not impact onshore activities; therefore, impacts would be the same as those described for the Proposed Action: **minor** and temporary to long term.			

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3.18.2.2 Alternative B: Impacts of the Proposed Action Alternative on Recreation and Tourism

3.18.2.2.1 Construction and Installation

Offshore Activities and Facilities

During construction, recreational offshore uses such as boating, fishing, diving, and wildlife and whale watching could be adversely impacted by Project activities. Detailed analysis by IPF is provided below. Construction EPMs would be implemented to minimize adverse impacts to recreators as practicable (see Table F-1 in Appendix F), including communication with vessel operators and implementation of ADLS.

Anchoring and new cable emplacement/maintenance: Anchoring could occur anywhere within the maximum work area under the Proposed Action, although impacts would be localized to specific anchoring sites and would be temporary in duration. The presence of as many as 61 construction vessels per construction day in 2023 and 2024 would increase navigation complexity for recreational vessels, requiring individual boats to navigate around Project vessels and work areas (see COP Table 3.3.10-2). Increased turbidity from anchoring could also briefly alter the behavior of species important to recreational fishing (see Section 3.9) and marine mammal sightseeing. However, temporary safety zones around each WTG site and each cable-laying vessel (anticipated to be established and monitored by Revolution Wind) would minimize potential conflicts for recreational uses. Anchoring activities would also be localized; therefore, construction impacts would represent a temporary, **minor** adverse impact on recreational users. Proposed Action anchoring impacts to fish species used for recreational fishing are addressed in Section 3.9.

Up to 4,009 acres of seafloor disturbance could occur from Proposed Action IAC and export cable installation within the recreation and tourism GAA. Installation of offshore cables would temporarily restrict recreation access within the cable routes. Recreational vessels traveling near the cable routes would also need to navigate around construction vessels. Revolution Wind would implement a comprehensive communication plan during offshore construction to inform all mariners, including commercial and recreational fishermen and recreational boaters, of construction activities and vessel movements. Communication would be facilitated through a fisheries liaison, a Project website, and public notices to mariners and vessel float plans (in coordination with the USCG). Therefore, potential changes in navigation routes due to Proposed Action construction would constitute a temporary, **minor** adverse impact.

Cable installation could also affect fish and mammals of interest for recreational fishing and sightseeing through dredging and turbulence, although no population-level impacts are expected (see Sections 3.13 and 3.9), resulting in short-term and **minor** adverse impacts on recreation and tourism.

Light: The Proposed Action would require nighttime lighting for construction vessels traveling to and working at the Project's offshore construction areas that could be visible by recreational users and tourists. The visual impact assessment prepared for Revolution Wind (see COP Appendix U3 [EDR 2021]) determined that the Project would not likely be easily detectable when viewed from a distance of 20 miles or more and that only 3% of the land area within the visual study area would contain views of the Project. Therefore, visual impacts on recreation and tourism would be temporary during construction, with **negligible** to **moderate** adverse impacts, based on the observed distance.

Noise: Construction noise could result in impacts on recreation and tourism through displacement of species important to recreational fishing and sightseeing in and around construction areas, resulting in a short-term **moderate** adverse impact to fishing, shellfishing, or whale-watching activities. Pile driving represents the loudest likely noise source during construction activities. Installation of a single monopile foundation is estimated to normally require 1 to 4 hours (6 to 12 hours maximum) of pile driving; up to three WTG monopile foundations would be installed in a 24-hour period. Therefore, recreational boaters near the RWEC and WTGs could also be temporarily inconvenienced by pile-driving noise.

Offshore construction and onshore cable installation near the landfall area at Quonset Point in North Kingstown, Rhode Island, could have short-term **negligible** to **minor** adverse impacts on the recreational enjoyment of the marine and coastal environments. This landing site is developed for military and industrial use; however, the closest public recreation area, Blue Beach, is located approximately 500 feet to the southwest of the Project’s landfall envelope. Compass Rose Beach, another public beach, and Martha’s Vineyard Fast Ferry are also located approximately 2,600 feet east of the southeast corner of the landfall envelope. Recreational users at these locations could experience temporary adverse impacts due to construction noise, if these noise levels exceed ambient noise conditions generated by ongoing industrial and port activities.

Presence of structures: The installation of up to 102 Project foundations are proposed within the recreation and tourism GAA. As also noted under the No Action Alternative, these offshore structures would impact recreation and tourism through increased navigational complexity, risk of allision or collision, attraction of recreational vessels to offshore wind structures for fishing and sightseeing, increased risk of fishing gear loss or damage by entanglement due to scour or cable protection, and potential difficulties in anchoring over scour or cable protection. Revolution Wind would minimize these **minor** to **moderate** adverse impacts through the navigation- and fishing-related EPMs listed in Appendix F. As part of these EPMs, Revolution Wind would establish temporary safety zones around construction areas and work with the USCG to communicate these zones and other work areas to the boating public via local Notices to Mariners. Additionally, the majority of recreational boating would occur more than 10 miles from Proposed Action WTGs and OSSs.

WTG and OSS construction could also affect recreation and tourism through visual impacts. During construction, offshore boaters and visitors on the coastline would see the upper portions of tall equipment such as mobile cranes. This equipment would move from turbine to turbine as construction progresses and thus would not be long-term fixtures.

Further, a survey-based study of 1,725 participants who typically visit the coast suggested that (based on visual simulations for prospective offshore wind facilities) only 10% of respondents would experience adverse visual impacts at a distance of 10 miles from shore (Parsons and Firestone 2018). The study suggests that coastal visitors could experience adverse reactions approaching 0% from Project WTGs at approximately 25 to 30 miles offshore. Based on the duration of construction activity and observed distance, visual contrast associated with the Proposed Action would have a temporary **negligible** adverse impact on recreation and tourism. Additionally, construction of offshore Project components could elicit a temporary beneficial impact through an increase in curiosity visits by individuals interested in WTG construction (Parsons and Firestone 2018).

Vessel traffic: Construction would result in as many as 61 construction vessels per construction day in 2023 and 2024 present at offshore work areas (see COP Table 3.3.10-2) on a daily basis. This increase in vessel volume for the Proposed Action would contribute to increased vessel traffic and associated vessel collision risk along routes between ports and the offshore construction areas if recreational boaters cross or approach cable and WTG locations. However, the majority of recreational boating occurs within 1 nm of shore (Starbuck and Lipsky 2013). Therefore, most recreational boaters in the GAA would experience a temporary, **minor** adverse impact from construction-related vessel traffic.

Onshore Activities and Facilities

<u>Anchoring and new cable emplacement/maintenance:</u> No anchoring impacts would occur as a result of onshore activities. Although onshore construction and installation would occur at the landing site during installation of the cable onshore/offshore transition vaults and during HDD or trenching in preparation for joining the onshore and offshore cables, the landfall work area is developed for non-recreational purposes. The Quonset Point Naval Air Station property is currently the home of the 143rd Airlift Wing of the Rhode Island Air National Guard and is in use as both a military base and a public airport with two active runways. A portion of the base has been converted into a business park. The onshore cable route would follow Circuit Drive and Camp Avenue to the OnSS. No public parks, beaches, or other public recreational facilities are within or immediately adjacent to this onshore route. However, the route travels through the Wickford Historic District, which is primarily a residential community with some commercial buildings that support a seasonal recreation economy. Three potential recreation opportunities—the Wickford Village/Harbor State Scenic Area, the Quonset-Martha's Vineyard Ferries, and Narraganset Bay—are also located in the vicinity. Additionally, as noted above, two public beaches—Blue Beach and Compass Rose Beach—are within 500 to 2,600 feet of the landfall envelope. However, installation of onshore cables would be localized. No direct impacts to public parks, beaches, or other public recreational facilities would occur. Therefore, recreation and tourism impacts during construction would be temporary and **minor** adverse.

<u>Light and Noise:</u> Light and noise from onshore construction activities could temporarily adversely impact the recreation experience of users if present or traveling on roads near the landing site, onshore cable route, and proposed onshore facilities. However, as previously noted, no public parks, beaches, or other public recreational facilities are within or immediately adjacent to this onshore route, OnSS, or ICF. Additionally, the onshore construction schedule would be designed to minimize impacts to the local community during the summer tourist season, generally between Memorial Day and Labor Day. The majority of onshore construction would be completed during daytime hours. Revolution Wind would generally comply with North Kingstown's noise ordinance; however, certain construction tasks such as concrete pours, HDD and landfall installation, and cable pulling or splicing, once started, would be continued through to completion. For nighttime construction work, downward-facing portable floodlights with a maximum height of approximately 18 feet would be used in compliance with all safety and security and local government requirements. Therefore, for most locals and tourists, any adverse impacts would be temporary **minor** impacts, but would not cause a loss to their overall experience.

<u>Presence of structures:</u> A new OnSS and ICF adjacent to the existing Davisville Substation would be constructed to support interconnection of the Project to the existing electrical grid. Vegetation clearing and taller equipment (e.g., cranes) would be visible from certain vantage points during construction of these onshore structures. However, inland residential/commercial areas and recreational sites would generally be screened from construction views due to the presence of existing development combined with forested areas (see COP Appendix U1). Therefore, any adverse impacts to overall recreator

experience would be temporary and **minor** adverse impacts, but would not cause a loss to the overall recreator experience.

Vessel traffic: Vehicle and equipment traffic from onshore cable construction activities could temporarily adversely impact the recreation experience of users if present or travelling on roads near the landing site and onshore cable route and facilities. However, as previously noted, no public parks, beaches, or other public recreational facilities are immediately adjacent to the onshore route, OnSS, or ICF. Additionally, Revolution Wind would coordinate with local authorities during onshore construction to minimize local traffic impacts. Therefore, any adverse impacts to tourism or overall recreator experience would be temporary and **minor** adverse.

3.18.2.2.2 Operations and Maintenance and Decommissioning

Offshore Activities and Facilities

Anchoring and new cable emplacement/maintenance: During the O&M, a limited number of vessels would be present in the Lease Area or RWEC at any one time. Potential anchoring impacts would be similar to the construction phase, but reduced due to fewer anchored vessels. No cable impacts are anticipated as the RWEC, IAC, and OSS transmission cable typically have no maintenance requirements unless a fault or failure occurs. If cable repair or replacement or remedial cable protection is required, maintenance activities would be limited to the disturbance corridors previously defined for construction. Therefore, O&M and decommissioning impacts would represent a temporary **minor** adverse impact on recreational users. Proposed Action anchoring and cable impacts to fish species used for recreational fishing are addressed in Section 3.9.

Impacts during decommissioning would be similar to the impacts during construction and installation.

Light: During operations, the Proposed Action would contribution to nighttime lighting due to required aviation hazard lighting of up to 102 WTGs and OSSs. The visual impact assessment prepared for Revolution Wind (see COP Appendix U3 [EDR 2021]) determined that the Project would not likely be easily detectable when viewed from a distance of 20 miles or more, and that only 3% of the land area within the visual study area would contain views of the Project. Revolution Wind has also committed to implement ADLS (as described in Appendix F) as a measure to reduce the duration of lighting impacts. As noted in Section 3.20, the Proposed Action’s aviation warning lighting, when visible, would add a developed/industrial visual element to views that were previously characterized by dark, open ocean. Due to the limited duration and frequency of such events and the distance of WTGs from shore, however, visible aviation hazard lighting for the Proposed Action would result in a long-term intermittent **negligible** adverse impact on recreation and tourism.

Impacts during decommissioning would be similar to the impacts during construction and installation.

Noise: Noise from O&M (predominately WTG operations) could result in impacts on recreation and tourism. Offshore operational noise from the WTGs would be similar to the noise described for other projects under the No Action Alternative and would thus have long-term **minor** adverse impacts. Impacts during decommissioning would be similar to the impacts during construction and installation.

Presence of structures: During O&M of the Proposed Action, the permanent presence of WTGs would create obstacles for recreational vessels. At their lowest point, WTG blades would be 94 feet above the surface. At this height, larger sailboats would need to navigate around the Lease Area, while smaller vessels could navigate through the Lease Area but would still need to adjust routes to bypass WTGs and OSS foundations. No restrictions on fishing or other recreational pursuits would occur during Project operations. However, some recreational anglers could avoid fishing in the Lease Area due to concerns about their ability to safely fish within or navigate through the area.

For recreational anglers harvesting HMS such as tunas, sharks, and billfish, the spacing of the WTGs could impact access to fishing locations. The fishing methods used and the size, strength, and swimming speed of these larger species require significantly more space for fishing compared to other species; as a result, the proposed separation between WTGs could be insufficient for this type of fishing. Anglers who do fish within the Lease Area would need to change their methods (i.e., they would not be able to allow their boats to drift and would need to correct course to avoid WTGs). See Section 3.9 for analysis on for-hire fishing impacts.

The presence of WTGs would also require the USCG to adjust their search and rescue planning and search patterns to allow aircraft to fly within the GAA, potentially leading to a less-optimized search pattern and a lower probability of success for lost or hurt recreationists (see Section 3.17).

The Proposed Action's WTGs would also affect recreation and tourism through visual impacts. When visible (i.e., on clear days in locations with unobstructed ocean views), WTGs would add a developed/industrial visual element to ocean views that were previously characterized by open ocean, broken only by transient vessels and aircraft passing through the view. However, the visual impact assessment prepared for Revolution Wind (see COP Appendix U3 [EDR 2021]) determined that the Project would not likely be easily detectable when viewed from a distance of 20 miles or more and that only 3% of the land area within the visual study area would contain views of the Project. Revolution Wind has voluntarily committed to use ADLS and non-reflective pure white or light gray paint color, as described in Appendix F to reduce impacts.

The visual contrast created by the WTGs could have a beneficial, adverse, or neutral impact on the quality of the recreation and tourism experience depending on the viewer's orientation, activity, and purpose for visiting the area. As discussed in Section 3.18.1, research suggests that at a distance of 15 miles, few beach visitors (only 6%) would select a different beach based on the presence of offshore wind turbines. An estimated 55 WTGs would fall within this distance, based on the proposed Project array. Considering these factors, BOEM expects the impact of visible WTGs on the use and enjoyment of recreation and tourist facilities and activities during O&M of the Proposed Action Alternative to be long term and **minor** adverse. While some visitors to south-facing coastal or elevated locations could alter their behavior, this changed behavior is unlikely to meaningfully affect the recreation and tourism industry as a whole. Additionally, increased beach visitation by individuals who view the WTGs as positive would offset some lost trips from visitors who consider views of WTGs to be negative (Parsons and Firestone 2018).

Overall, the impacts on most recreational pursuits would be long term but **minor** adverse, while the impact on for-hire fishing would be **moderate** adverse because these enterprises are more likely to be materially affected by displacement, competition for resources, and longer transit times in a manner similar to commercial fishing businesses.

Conversely, charter cruises could also choose to market the operational WTGs as a tourist destination, although their distance from shore could limit some interest. Scour protection around the WTG foundations would likely attract forage fish as well as game fish, which could provide new opportunities for certain recreational anglers. A 1989 survey of recreational fishermen and divers in the Gulf of Mexico found that fishermen were willing to travel up to 45 nm offshore and divers 77 nm offshore to visit abandoned platforms that have been reefed (Stanley and Wilson 1989). A subsequent 2002 study (Hiett and Milon 2002) also found that that there is substantial recreational activity associated with the presence of oil and gas structures in the Gulf of Mexico from Alabama through Texas. These structures range from directly offshore in 10-foot water depths to complex facilities in water depths up to almost 10,000 feet at more than 80 miles from shore (NOAA 2021). The report estimated a total of $324.6 million in economic output in coastal counties of the Gulf region associated with fishing and diving activities near oil and gas structures. A survey of United Kingdom offshore recreational fishermen by Hooper et al. (2017) found that respondents frequently fished at offshore wind farms, with a mean distance from shore of 10 nm. Approximately one quarter of the respondents reported having fished within or around the perimeter of wind farms. Likewise, evidence from Block Island Wind Farm indicates an increase in recreational fishing near the WTGs (Smythe et al. 2018). These surveys suggest that the Project could attract recreational fishing and diving activity, providing a long-term **minor** benefit. The Project could also increase tourism activity during peak tourism months (Carr-Harris and Lang 2019).

Impacts during decommissioning would be similar to the impacts during construction and installation.

<u>Vessel traffic:</u> For regularly scheduled maintenance and inspections, Revolution Wind anticipates that, on average, up to nine crew transfer vessels or service operation vessels would operate in the Lease Area. In other maintenance or repair scenarios, additional vessels could be required. However, this low volume of vessel traffic would not be anticipated to affect ongoing recreational use. O&M of the Proposed Action would therefore have **negligible** adverse impacts on onshore or offshore recreation and tourism.

Impacts during decommissioning would be similar to the impacts during construction and installation.

Onshore Activities and Facilities

<u>Anchoring and new cable emplacement/maintenance:</u> No anchoring impacts would occur as a result of onshore activities. No onshore cable maintenance would be required unless a fault or failure occurs. If cable repair or replacement or remedial cable protection is required, maintenance activities would be limited to the disturbance corridors previously defined for construction. Therefore, O&M and decommissioning impacts would represent a **negligible** adverse impact on recreational users.

<u>Light:</u> Based results of the viewshed analysis (see COP Appendix U1 [EDR 2021]), portions of the lightning masts for OnSS and ICF features could be visible from some views. However, lighting at these facilities would be limited to yard and task lighting for emergency maintenance or repairs. Both categories would be switched lights and only in use if staff are present. Operational lighting for the OnSS and ICF would comply with Quonset Development Corporation lighting regulations and be mounted with the lamp horizontal to the ground (light facing straight down) or with a lamp tilt no more than 25 degrees from the horizon. As such, it is anticipated that the OnSS and ICF would result in **negligible** adverse lighting impacts to the recreation and tourism activities in the GAA. Impacts during decommissioning would be similar to the impacts during construction and installation.

<u>Noise:</u> Operations of onshore Project components (i.e., offshore to onshore transition joint bays, onshore transmission cable route, OnSS, and ICF) would have **negligible** adverse noise impacts intermittently

over the life of the Project to onshore recreation and tourism because these components would only require periodic routine maintenance.

Impacts during decommissioning would be similar to the impacts during construction and installation.

<u>Presence of structures:</u> Based on results of the viewshed analysis (see COP Appendix U1 [EDR 2021]), it is anticipated that the OnSS and ICF could be visible from approximately 15% of the viewshed analysis area. However, the presence of existing landscape vegetation along roadways could further reduce the extent of visual impacts. For more distant views from Wickford Historic District and Wickford Harbor/Wickford Village State Scenic Area, and Narragansett Bay, visibility would only include the upper portions of a few proposed transmission structures. However, where visible at foreground distances, the proposed OnSS and ICF could introduce new industrial/utility structures into the landscape. Nevertheless, the proposed OnSS and ICF would not be out of scale or character with the existing types of development currently present in the vicinity, such as the existing Davisville Substation or the structures at nearby Quonset Business Park. As such, it is anticipated that the OnSS and ICF would result in **negligible** adverse visual impacts to recreation and tourism activities in the GAA.

Impacts during decommissioning would be similar to the impacts during construction and installation.

<u>Vessel traffic:</u> Potential traffic impacts would be similar to the construction phase but likely reduced due to fewer equipment and vehicle trips. Impacts during decommissioning would be similar to the impacts during construction and installation: temporary and **minor** adverse.

3.18.2.2.3 Cumulative Impacts

Offshore Activities and Facilities

<u>Anchoring and new cable emplacement/maintenance:</u> Up to approximately 5,338 acres of anchoring and 14,157 acres of cabling seafloor disturbance could occur from ongoing and planned actions, including the Proposed Action, in the recreation and tourism GAA. Project-related construction anchorages would noticeably add to disturbances of marine species and their habitats important to recreational fishing and could require recreational and tourism vessels to navigate around moving and anchored construction-related vessels while in transit. The buried cabling would also present short-term navigational hazards. Therefore, the Proposed Action when combined with past, present, and reasonably foreseeable activities would result in short-term and long-term **minor** adverse cumulative impacts on recreation and tourism.

<u>Light:</u> New lighting from the Proposed Action would contribute to a 11% increase in in-water lighting sources from past, present, and reasonably foreseeable future projects within the GAA by introducing built visual elements to views previously characterized by dark, open ocean. Collectively, 9% of the WTG positions envisioned in the GAA would be less than 15 miles from coastal locations with views of the WTGs.

Given the distance from recreational viewers and atmospheric interference, lighting from the Proposed Action, when combined with past, present, and reasonably foreseeable projects, would result in long-term intermittent **minor** adverse cumulative impacts on recreation and tourism.

<u>Noise:</u>. Noise from construction could lead to the displacement of fish in and around construction sites, leading to spatial competition, depending on migrating patterns. Recreational boaters and tourists would not be permitted to approach active construction zones and would therefore not be expected to experience

noise impacts from offshore construction. Because of the distance from receptors, the Proposed Action when combined with past, present, and reasonably foreseeable activities would result in localized short-term **minor** to **moderate** adverse cumulative impacts on recreation and tourism due to construction activities, whereas noise from O&M activities would result in long-term **negligible** adverse cumulative impacts.

Presence of structures: The Proposed Action would noticeably add up to 102 foundations to the 953 foundations estimated for the No Action Alternative within the GAA. New structures related to the Proposed Action would add to the long-term impacts on recreation and tourism throughout the life of the Project (up to 35 years, plus up to an additional 2 years for decommissioning) by increasing navigational complexity; risks of structure allision; route adjustments for races, sightseeing, and fishing; loss and damage of fishing gear to scour and cable protection; and difficulty anchoring over scour and cable protection. However, new in-water structures from the Proposed Action could benefit recreation and tourism by attracting recreational vessels to WTGs for fishing and sightseeing activities. Therefore, new in-water structures from the Proposed Action when combined with past, present, and reasonably foreseeable activities would result in short-term and long-term **minor** to **moderate** adverse and long-term **minor** beneficial cumulative impacts on recreation and tourism.

Construction and O&M of the Project would also noticeably increase the visual impacts on recreational and tourism users by adding up to 100 WTGs and two OSSs to the No Action Alternative. Based on visual simulations described in Sections 3.18.1.1, 3.18.2.2.1, and 3.18.2.2.2, the visibility of large offshore structures is not expected to impact shore-based recreation and tourism as a whole. Cumulative visual impacts on recreation and tourism resulting from the Proposed Action, when combined with past, present, and reasonably foreseeable projects, would be short term and **minor** adverse for onshore viewers at sensitive viewing locations because of the distance and natural atmospheric interference. Cumulative visual impacts on recreation and tourism resulting from the Proposed Action, when combined with past, present, and reasonably foreseeable projects, would be short term **minor** to **moderate** adverse for offshore recreational users and would increase as users approach the WTGs. Impacts to viewers at sensitive viewing locations are addressed in Section 3.20.

Vessel traffic: Project vessels would noticeably add to disturbances of marine species and their habitats important to recreational fishing and could require recreational and tourism vessels to navigate around moving construction-related vessels while in transit. However, non-Project traffic would be able to adjust routes and avoid the work area and transiting construction vessels. BOEM estimates a peak of 276 vessels at sea on a daily basis due to offshore wind project construction and O&M over a 10-year time frame, with most of these vessels remaining in the vicinity of their respective lease areas. Therefore, the Proposed Action when combined with past, present, and reasonably foreseeable activities would result in short-term and long-term **minor** adverse cumulative impacts on recreation and tourism.

Onshore Activities and Facilities

Anchoring and new cable emplacement/maintenance: No anchoring impacts would occur as a result of onshore activities. No onshore cable maintenance would be required unless a fault or failure occurs. If cable repair or replacement or remedial cable protection is required, maintenance activities would be limited to the disturbance corridors previously defined for construction. Therefore, the Proposed Action when combined with past, present, and reasonably foreseeable projects would result in temporary **negligible** adverse cumulative impacts to onshore recreation and tourism.

Light: Construction associated with the Proposed Action could add temporary minor adverse light impacts experienced by onshore recreational users near the landfall work area, onshore transmission cable route, or onshore facilities or from the aviation hazard lighting on the new WTGs. Long-term increases in operational lighting from the Proposed Action would be **negligible** adverse. Therefore, the Proposed Action when combined with past, present, and reasonably foreseeable projects would result in temporary **minor** adverse cumulative impacts to onshore recreation and tourism.

Noise: As with lighting, construction activities would add noise from the construction of onshore facilities to the ambient noise levels of the No Action Alternative. Onshore construction noise would be localized to the source, short term **minor** to **moderate** adverse, depending on the distance of the receptor from the source. Long-term increases in operational noise from the Proposed Action would be **negligible** adverse. Therefore, the Proposed Action when combined with past, present, and reasonably foreseeable projects would result in temporary **minor** adverse cumulative impacts to onshore recreation and tourism.

Presence of structures: Onshore construction and installation would add an O&M facility, an interconnection facility, and an OnSS to the No Action Alternative. These new onshore structures would only result in **minor** adverse visual impacts experienced by recreational users due to the existing settings at these locations (see Section 3.20 for details on potential visual impacts). When considered cumulatively with past, present, and reasonably foreseeable activities, the Proposed Action would result in temporary **negligible** to **minor** adverse cumulative visual impacts on recreation and tourism.

Vessel traffic: Construction vehicles associated with the Proposed Action could add traffic delays experienced by recreational travelers on local roadways. Long-term increases in operational traffic from the Proposed Action would be **negligible** adverse. Therefore, the Proposed Action, when combined with past, present, and reasonably foreseeable projects, would result in temporary **minor** adverse cumulative impacts to onshore recreation and tourism.

3.18.2.2.4 Conclusions

Project construction and installation and decommissioning would introduce noise, lighting, human activity, vehicles and vessels (increasing potential collision risk), and interruption to access points in the GAA. Noise, lighting, and human activity impacts from Project O&M would occur, although at lower levels than those produced during construction and decommissioning. BOEM anticipates that the impacts resulting from the Proposed Action alone would range from **negligible** to **minor** adverse and short term to long term. Project activities are expected to contribute to several IPFs, the most prominent being noise and vessel traffic during construction and the presence of offshore structures during operations. Noise and vessel traffic would have impacts on visitors, who may avoid onshore and offshore noise sources and vessels, and impacts on recreational fishing and sightseeing as a result of the impacts on fish, invertebrates, and marine mammals. BOEM expects the overall impact on recreation and tourism from the Proposed Action alone to be **minor** adverse; however, the overall effect would be small, and recreation and tourism would be expected to recover completely without remedial or mitigating action.

In the context of other reasonably foreseeable environmental trends and planned actions, the impacts under the Proposed Action resulting from individual IPFs would range from **negligible** to **moderate** adverse and **minor** beneficial. Impacts would result from short-term impacts during construction: noise, anchored vessels, and hindrances to navigation; and the long-term presence of cable hard cover and structures in the GAA during operations, with resulting impacts on recreational vessel navigation and visual quality. Beneficial impacts would result from the reef effect and sightseeing attraction of offshore wind energy structures. Considering all the IPFs together, BOEM anticipates that the overall impacts associated with the Proposed Action, when combined with past, present, and reasonably foreseeable activities, would result in **minor** adverse impacts and **minor** beneficial impacts to recreation and tourism. The overall effect would be small, and recreation and tourism would be expected to recover completely with no mitigating action required.

3.18.2.3 Alternatives C, D, E, and F

Table 3.18-2 provides a summary of IPF findings for these alternatives.

3.18.2.3.1 Conclusions

Although Alternatives C through F would reduce the number of WTGs and associated IACs, the presence of WTGs could still increase congestion, space conflicts, navigation risks, and the potential for collision, albeit at lower levels than the Proposed Action. The reduced number of WTGs under these alternatives could provide a long-term beneficial impact for some recreational viewers. Therefore, BOEM expects that the impacts resulting from each alternative alone would range from **negligible** to **moderate** adverse.

In the context of other reasonably foreseeable environmental trends and planned actions, BOEM also expects that each alternative's impacts would be similar to the Proposed Action (with individual IPFs leading to impacts ranging from **negligible** to **moderate** adverse and **minor** beneficial). The overall impacts of each alternative when combined with past, present, and reasonably foreseeable activities would therefore be the same as those under the Proposed Action: **minor** adverse and **minor** beneficial.

3.18.2.4 Mitigation

If BOEM requires potential additional mitigation measures identified in Table F-2 of Appendix F, such as developing a navigation safety plan and developing a construction schedule that minimizes overlap with recreational fishing tournaments and other important seasonal recreational fishing events, minor and short-term adverse impacts for local residents who recreate offshore would be further reduced.

3.19 Sea Turtles

3.19.1 Description of the Affected Environment and Environmental Consequences of the No Action Alternative for Sea Turtles

Geographic analysis area: The sea turtles GAA is described in Appendix G and illustrated in Figure 3.19-1. The intent of the GAAs used in this EIS is to define a reasonable boundary for assessing the potential effects, including cumulative effects, resulting from the development of an offshore wind energy industry on the mid-Atlantic OCS. GAAs for marine biological resources are necessarily large because marine populations range broadly and cumulative impacts can be expressed over broad areas. GAAs are not used as a basis for analyzing the effects of the Proposed Action, which represent a subset of these broader effects and expressed over a smaller area. These impacts are analyzed specific to each IPF. The GAA for sea turtles comprises the Northeast Shelf and Southeast Shelf Large Marine Ecosystems, as shown in Figure 3.19-1. This broad area captures the typical movement range within U.S. waters of most sea turtles that could occur within the Project vicinity during the construction and installation, O&M, and decommissioning of the Project. Thus, while Project-related impacts to sea turtle habitat are restricted to a relatively small GAA, the GAA for Project impacts to sea turtles is necessarily large due to their movement range.

Affected environment: Four species of sea turtles are known to occur in or near the proposed RWF and RWEC, and all are protected species under the ESA. These are the green sea turtle (*Chelonia mydas*), leatherback sea turtle (*Dermochelys coriacea*), loggerhead sea turtle (*Caretta caretta*), and Kemp's ridley sea turtle (*Lepidochelys kempii*). The potential impacts of the Proposed Action to these species are assessed in Section 3.19.2. The hawksbill sea turtle (*Eretmochelys imbricata*) is also protected under the ESA but is exceedingly rare in the Project vicinity (Kenney and Vigness-Raposa 2010) (see Figure 3.19-1). The proposed RWF and RWEC is considered outside the normal range of hawksbill turtles, which range predominantly in warmer waters to the south. Individual hawksbill turtles have occasionally occurred in and near the southern New England area after being stunned by exposure to unusual cold-water events and subsequently transported northward by the Gulf Stream into the region. These occurrences are not representative of normal behaviors or distribution. Similarly, while this species does occur in the GAA for sea turtles (defined in Appendix E), the Proposed Action is unlikely to contribute to any measurable cumulative effects, and hawksbill sea turtles are therefore not considered further in this EIS.

Sea turtles primarily inhabit tropical and subtropical seas throughout the world, with several species seasonally ranging into temperate zones to forage. Sea turtles are morphologically adapted for continuous swimming, and they can remain underwater for extended periods, ranging from several minutes to several hours, depending on factors such as daily and seasonal environmental conditions and specific behavioral activities associated with dive types (Hochscheid 2014; National Science Foundation [NSF] and USGS 2011). These adaptations are important because sea turtles often travel long distances between their feeding grounds and nesting beaches (Meylan 1995). There are no nesting beaches or other designated critical habitats in the vicinity of the RWF (Greater Atlantic Regional Fisheries Office [GARFO] 2020), meaning that individuals occurring in the proposed RWF and RWEC are either migrating or foraging. As such, these individuals likely spend the majority of time below the surface, although specifics are species dependent. Underwater observations of 73 sea turtles with 2,742 minutes of video in the mid-Atlantic found that loggerhead sea turtles were within the near-surface region of the water column a median of 42% of the time (Patel et al. 2016).

The combination of sightings, strandings, tag, and bycatch data provides the best available information on sea turtle distribution. This section summarizes data from sightings and surveys of the waters around the Lease Area (Kraus et al. 2016), the NMFS Sea Turtle Stranding and Salvage Network (STSSN) (NMFS STSSN 2020), recent available density estimates (Denes et al. 2020a), and historic regional data (Kenney and Vigness-Raposa 2010). Denes et al. (2020a) compiled estimated seasonal densities for Kemp’s ridley, leatherback, and loggerhead sea turtles in the GAA using data obtained from U.S. Navy Operating Area Density Estimates and Ocean Biodiversity Information System Spatial Ecological Analysis of Megavertebrate Populations (OBIS-SEAMAP) databases (Halpin et al. 2009; Navy 2007, 2012). Green sea turtle densities were not estimated because suitable data for the region are limited. Table 3.19-1 summarizes potential sea turtle occurrence in the southern New England coastal waters off Rhode Island and Massachusetts. Potential effects to sea turtles, which are discussed in Section 3.19.2, are based on the likelihood of occurrence.

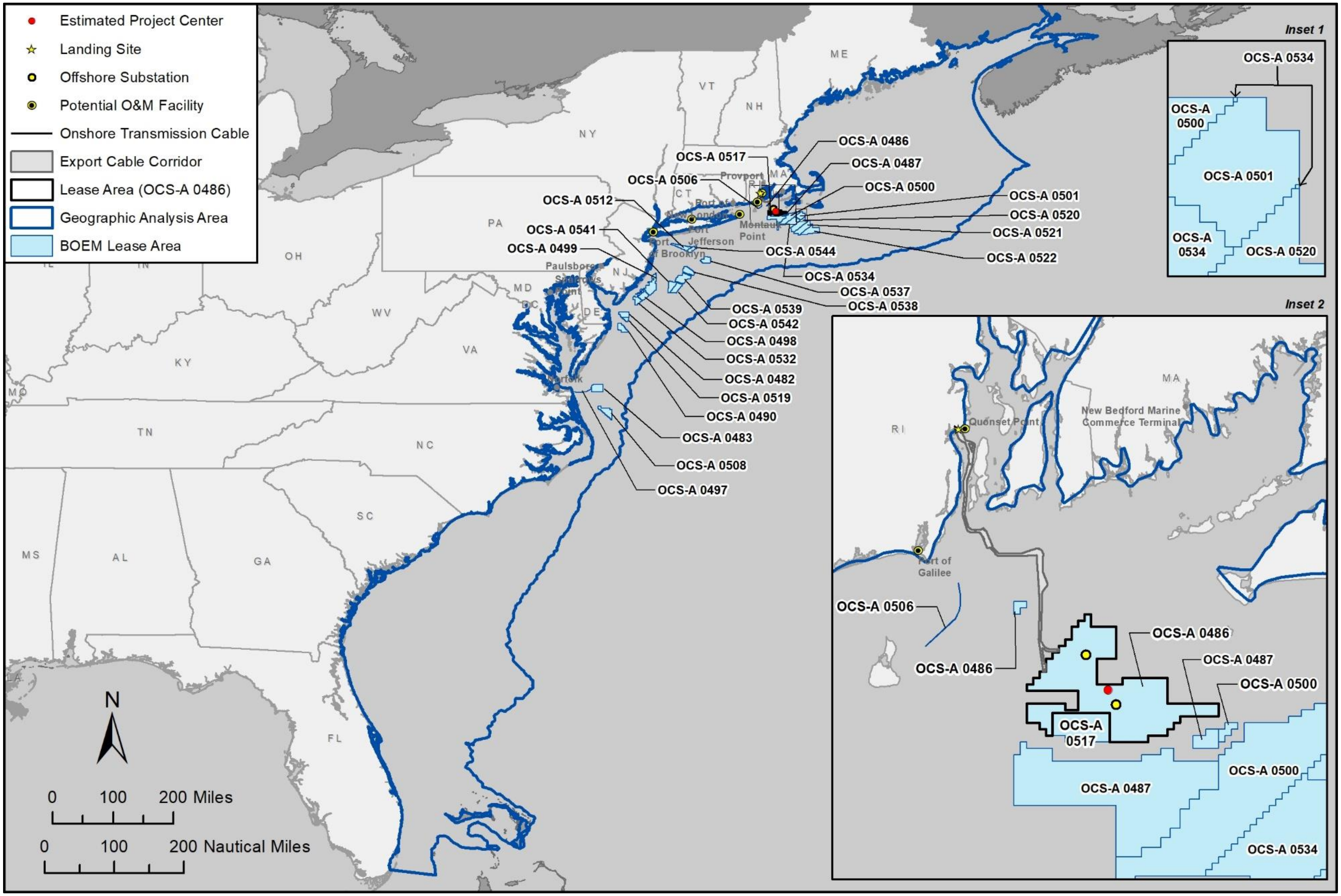

Figure 3.19-1. Geographic analysis area for sea turtles.

Table 3.19-1. Frequency of Sea Turtle Species Occurrence in the Revolution Wind Farm and Revolution Wind Export Cable

Common Name	Scientific Name	Distinct Population Segment*/Population	Endangered Species Act Status*	Frequency of Occurrence[†,¶]	Seasonal Occurrence[‡,§]	Likelihood of Occurrence[§,¶]	Included in Impact Analysis?
Green sea turtle	*Chelonia mydas*	North Atlantic	T	Uncommon, limits of range	May to November	Unlikely/ uncommon	Yes
Hawksbill sea turtle	*Eretmochelys imbricata*	Throughout range	E	Rare, outside range	May to November	Exceedingly unlikely	No, outside limits of range
Leatherback sea turtle	*Dermochelys coriacea*	Atlantic[±±]	E	Common	May to November	Likely	Yes
Loggerhead sea turtle	*Caretta caretta*	Northwest Atlantic	T	Common	May to November	Likely	Yes
Kemp's ridley sea turtle	*Lepidochelys kempii*	Throughout range	E	Regular	May to November	Likely but infrequent	Yes

Notes: Data from NMFS STSSN (2020).

* DPS = distinct population segment, E = endangered, T = threatened.

† Data from Kenney and Vigness-Raposa (2010). Common = fewer than 100 observations, regular = 10–100 observations; rare = fewer than 10 observations.

‡ Data from GARFO (2020).

§ Data from NEFSC and SEFSC (2018).

¶ Based on observations by Kraus et al. (2013, 2014, 2016), O'Brien et al. (2020, 2021a, 2021b), and Quintana et al. (2019).

±± A Northwest Atlantic DPS to be listed as threatened has been proposed for leatherback sea turtles (85 *FR* 48332). The Atlantic population considered herein includes this proposed DPS.

Green sea turtle: Green sea turtles are found in tropical and subtropical waters around the globe. They are most commonly observed feeding in the shallow waters of reefs, bays, inlets, lagoons, and shoals that are abundant in algae or marine grass (NMFS and USFWS 2007). In U.S. waters, they are typically found in the Gulf of Mexico or coastal waters south of Virginia (USFWS 2021). Juveniles and subadults are occasionally observed in Atlantic coastal waters as far north as Massachusetts (NMFS and USFWS 1991), including the waters of Long Island Sound and Cape Cod Bay (Cetacean and Turtle Assessment Program 1982). The species' primary nesting beaches are located in Costa Rica, Mexico, the United States (Florida), and Cuba. According to Seminoff et al. (2015), nesting trends are generally increasing for this population. Based on feeding and habitat preferences, the species is less likely to occur in the RI/MA WEA and MA WEA. Kenney and Vigness-Raposa (2010) recorded one confirmed sighting within the RI/MA WEA in 2005. The STSSN reported one offshore and 20 inshore green sea turtle strandings between 2017 and 2019, and green sea turtles are found each year stranded on Cape Cod beaches (NMFS STSSN 2020; Wellfleet Bay Wildlife Sanctuary [WBWS] 2018). Five green turtle sightings were recorded off the Long Island shoreline 10 to 30 miles southwest of the RI/MA WEA in aerial surveys conducted from 2010 to 2013 (NEFSC and SEFSC 2018), but none were positively identified in multiseason aerial surveys of the RI/MA WEA from October 2011 to June 2015 (Kraus et al. 2016). Because of the limited number of sightings, uncertainty regarding survey method effectiveness, and difficulties observing juveniles, it is not possible to develop precise occurrence probability or density estimates for this species, but occurrence in the RWF and RWEC is expected to be uncommon and limited to small numbers.

Leatherback sea turtle: The leatherback is the most globally distributed sea turtle species, ranging broadly from tropical and subtropical to temperate regions of the world's oceans (NMFS and USFWS 1992). Leatherbacks are a pelagic species, but they are commonly observed in coastal waters along the OCS (NMFS and USFWS 1992). The breeding population estimate (total number of adults) in the North Atlantic is 34,000 to 95,000, and, aside from the western Caribbean, nesting trends at all other Atlantic nesting sites are generally stable or increasing (NMFS and USFWS 2013; Turtle Expert Working Group 2007). Atlantic Marine Assessment Program for Protected Species surveys conducted from 2010 through 2013 routinely documented leatherbacks in New England waters, including the RI/MA WEA, during the summer months (NEFSC and SEFSC 2018). Kraus et al. (2016) recorded 153 observations in monthly aerial surveys, all between May and November, with a strong peak in August. Monthly aerial surveys on the New York Bight from 2017 through 2020 documented a total of 37 leatherback sea turtles, with an additional 503 unidentified sea turtles observed (Tetra Tech and LGL Ecological Research Associates, Inc. 2020). During the summer (June–August) and fall (September–November) months; leatherback density within the RI/MA WEA (refer to Figure 1.1-2) was estimated to be 0.0063 animals per km^2 and 0.0087 animals per km^2, respectively, compared to densities of effectively zero for the rest of the year (Kusel et al. 2021). The STSSN reported 19 offshore and 77 inshore leatherback sea turtle strandings between 2017 and 2019, the highest number among all turtle species reported (NMFS STSSN 2020). Kraus et al. (2016) data indicated that leatherbacks would be the most abundant sea turtle species in the RWF and RWEC, which is consistent with the other information on sea turtle occurrence in the vicinity presented here. Based on this information, leatherback sea turtles are expected to occur commonly in the RWF and RWEC between May and November, with the highest probability of occurrence from July through October (Sherrill-Mix et al. 2008).

Loggerhead sea turtle: Foraging loggerhead sea turtles range widely and have been observed along the entire Atlantic coast as far north as Canada (Brazner and McMillan 2008; Ceriani et al. 2014; Shoop and Kenney 1992). Regional abundance on the northwest Atlantic, corrected for unidentified turtles in proportion to the ratio of identified turtles, estimates about 801,000 loggerheads (NEFSC and SEFSC 2011). The three largest nesting subpopulations responsible for most of the production in the western North Atlantic (peninsular Florida, northern United States, and Quintana Roo, Mexico) have all been declining since at least the late 1990s, thus indicating a downward trend for this population (Turtle Expert Working Group 2009). In southern New England, loggerhead sea turtles can be found seasonally, primarily during the summer and fall, but are typically absent during the winter (Kenney and Vigness-Raposa 2010; Shoop and Kenney 1992). Atlantic Marine Assessment Program for Protected Species surveys reported loggerhead sea turtles as the most commonly sighted sea turtles on the shelf waters from New Jersey to Nova Scotia, Canada. During the December 2014 to March 2015 aerial abundance surveys, 280 individuals were recorded (Palka et al. 2017). Large concentrations were regularly observed south and east of Long Island near the RI/MA WEA (NEFSC and SEFSC 2018). Kraus et al. (2016) observed loggerhead sea turtles within the RI/MA WEA in the spring, summer, and fall, with the greatest density of observations in August through September. Kusel et al. (2021) estimated the density of loggerhead sea turtles within the RI/MA WEA to be 0.00755 animals per km^2 at peak occurrence during the fall months, 0.00206 animals per km^2 during the summer months, and 0.00084 animals per km^2 for the rest of the year. The STSSN reported six offshore and 58 inshore loggerhead sea turtle strandings between 2017 and 2019 (NMFS STSSN 2020). In New York State waters, the New York Marine Rescue Center (NYMRC) documented 816 strandings of loggerhead sea turtles from 1980 to 2018 (NYMRC 2021). Winton et al. (2018) estimated densities using data from 271 satellite tags deployed on loggerhead sea turtles between 2004 and 2016 and found that tagged loggerheads primarily occupied the OCS from Long Island, New York, south to Florida, but relative densities in the RI/MA WEA increased during the period between July and September. Collectively, available information indicates that loggerhead sea turtles are expected to occur commonly in the RWF and RWEC as adults, subadults, and juveniles from the late spring through fall, with the highest probability of occurrence from July through September (Winton et al. 2018).

Kemp's ridley sea turtle: Kemp's ridley sea turtles are most commonly found in the Gulf of Mexico and along the U.S. Atlantic coast. The species is primarily associated with habitats on the OCS, with preferred habitats consisting of sheltered areas along the coastline, including estuaries, lagoons, and bays (Burke et al. 1994; NMFS 2019), and nearshore waters less than 120 feet (37 m) deep (Seney and Landry 2008; Shaver et al. 2005; Shaver and Rubio 2008), although they can also be found in deeper offshore waters. Kemp's ridley sea turtle nesting is largely limited to the beaches of the western Gulf of Mexico, primarily in Tamaulipas, Mexico. Nesting also occurs in Veracruz, and a few historical records exist for Campeche, Mexico. In the United States, nesting occurs primarily in Texas and occasionally in Florida, Alabama, Georgia, South Carolina, and North Carolina (NMFS and USFWS 2015). Nesting outside of Gulf of Mexico states is rare but has been observed as far north as New York State (NPS 2018). Recent data show that the total number of recorded nests from all beaches in Mexico peaked in 2012 at 22,458 but declined to 12,060 in 2014, the last year for available data (NMFS and USFWS 2015). Juvenile and subadult Kemp's ridley sea turtles are known to travel as far north as Cape Cod Bay during summer foraging (NMFS et al. 2011). Visual sighting data are limited because this small species is difficult to observe using typical aerial survey methods (Kraus et al. 2016). In all, five observations were recorded in the RI/MA WEA during 4 years of aerial surveys, all in August and September 2012 (Kraus et al. 2016). The species has been sighted near the proposed RWF in other survey efforts, mostly to the south and west of the RI/MA WEA (Right Whale Consortium 2019).

Kusel et al. (2021) conservatively estimate the density of Kemp’s ridley sea turtles within the RI/MA WEA to be 0.00006 animals per km^2 throughout the year for exposure modeling purposes. However, this estimate does not accurately reflect seasonality of occurrence. Like all sea turtle species occurring in the region, the Kemp’s ridley sea turtle is most commonly observed from late spring through early fall when suitable water temperatures are present, with occurrences later in the year limited to individuals that have been cold stunned and are outside their normal seasonal range. The STSSN reported six offshore and 69 inshore Kemp’s ridley sea turtle strandings between 2017 and 2019 (NMFS STSSN 2020), and the NYMRC has documented the stranding of 620 Kemp’s ridley sea turtles within New York State waters between 1980 and 2018 (NYMRC 2021). Cold-stunned Kemp’s ridley sea turtles are often found stranded on the beaches of Cape Cod (Lui et al. 2019; WBWS 2019). Based on this information, Kemp’s ridley sea turtles could occur infrequently as juveniles and subadults from July through September. The highest likelihood of occurrence within the Project limits is along the RWEC corridor in the protected waters of Narragansett Bay. Occurrence in the RWF is possible the likelihood of occurrence is difficult to assess from available data because this species is difficult to detect in visual surveys (Kraus et al. 2016). On this basis, Kemp’s ridley sea turtles could occur in the RWF and RWEC in low numbers on an annual basis throughout the life of the Project.

3.19.1.1 Future Offshore Wind Activities (without Proposed Action)

This section discloses potential sea turtle impacts associated with future offshore wind development. Analysis of impacts associated with ongoing activities and future non–offshore wind activities is provided in Appendix E2.

Offshore Activities and Facilities

<u>Accidental releases and discharges:</u> BOEM prohibits the discharge or disposal of solid debris into offshore waters during any activity associated with the construction and operation of offshore renewable energy facilities (30 CFR 585.105(a)). The USCG similarly prohibits the dumping of trash or debris capable of posing entanglement or ingestion risk (MARPOL, Annex V, Public Law 100−220 (101 Stat. 1458)). BOEM also requires applicants to develop spill response and containment plans to quickly address accidental spills of fuels, lubricants, and other contaminants. While marine vessels are an inherent source of accidental releases of trash, debris, and contaminants, these requirements would effectively avoid and minimize these impacts such that the resulting effects to sea turtles would be **negligible** adverse.

Trash or water quality contaminants could be accidentally released as a result of increased human activity associated with future offshore wind construction activities. All species of sea turtles have been documented ingesting plastic fragments (Bugoni et al. 2001; Hoarau et al. 2014; Nelms et al. 2016) and a variety of other anthropogenic waste (Tomás et al. 2002), likely mistaking debris for potential prey items (Schyuler et al. 2014). Ingesting trash or exposure to aquatic contaminants can be lethal to sea turtles. However, turtles may also be affected sublethally in a variety of ways, which could include experiencing depressed immune system function; poor body condition; and reduced growth rates, fecundity, and reproductive success (Gall and Thompson 2015; Hoarau et al. 2014; Nelms et al. 2016; Schuyler et al. 2014). Sea turtles could additionally become entangled in debris, causing lethal or injurious impacts.

Entanglement in lost fishing gear is a significant cause of mortality in both juvenile and adult sea turtles and was noted as a threat to recovery for multiple ESA-listed turtles in the marine environment (NMFS and USFWS 1991, 1992; NMFS et al. 2011). Based on a recent global review, 5.5% of encountered sea turtles were found to be entangled, and 90.6% of these were dead (Duncan et al. 2017). Lost or discarded fishing gear was associated with most of these entanglements, and many experts believed that these impacts could be causing population-level impacts in some areas. Aquatic contaminant exposure could also result in mortality, and sublethal effects could impact many of the species' physiological systems during all life stages (Bembenek-Bailey et al. 2019; Mitchelmore et al. 2017; Shigenaka et al. 2010; Vargo et al. 1986). Furthermore, accidental releases could indirectly impact sea turtles by impacting prey species. However, all vessels would comply with USCG regulations, and wind farm construction projects would comply with additional BOEM requirements that would avoid and minimize accidental releases of trash or other debris. Therefore, potential accidental releases of trash or debris would not appreciably contribute to adverse impacts to sea turtles and would be **negligible** adverse.

Impacts to sea turtles from accidental spills and releases associated with ongoing future non–offshore wind activities are likely to increase over the next 30 years commensurate with increases in vessel traffic. Future offshore wind activities would contribute to this increased risk. A total of approximately 18 million gallons of coolants, fuels, oils, and lubricants could be stored within WTG foundations and OSSs across all projected offshore wind projects along the Atlantic coast. A high-volume spill of toxic materials (fuels, lubricants, and other contaminants) could potentially injure or kill several individual sea turtles and adversely affect habitat suitability. Given that the affected habitats would be at or outside the northern limit of range of most species, the number of individuals impacted would be small relative to population size. In the unlikely event of a high-volume spill, impacts of this magnitude would constitute a moderate effect on sea turtles. BOEM anticipates that the likelihood of a major spill of petroleum products and other toxic substances during construction is very low (a 1 in 1,000 chance per year) due to vessel allisions, collisions, O&M activities, or weather events (Bejarano et al. 2013). WTGs and OSSs are generally self-contained and would not generate discharge. All future offshore wind projects would be required to comply with regulatory requirements related to the prevention and control of accidental spills administered by the USCG and the BSEE Oil spill response plans are required for each project and would provide for rapid spill response, clean-up, and other measures that would help to minimize potential impacts on affected resources. Given the low probability of a large spill event, impacts to sea turtles from this IPF are likely to be **negligible** adverse.

<u>Climate change:</u> Global climate change is an ongoing potential risk to sea turtles, although the associated impact mechanisms are complex, not fully understood, and difficult to predict with certainty. This is particularly true when considering how the effects of climate change may interact with other IPFs. Possible impacts to sea turtles due to climate change include increased storm severity and frequency; changes in nearshore habitat suitability caused by increased erosion from upland sources; exposure to disease; ocean acidification; and altered habitat, prey availability, ecology, and migration patterns (Hawkes et al. 2009).

However, some of these potential impacts could also contribute to potential benefits associated with the creation of artificial reef habitat and could represent an increasing impact over the life of the Project. The potential implications of these and other related environmental changes and how they interact with the effects of regional offshore wind development are complex and uncertain. For example, the distribution of leatherback sea turtles in the North Atlantic is shifting northward in response to changes in water temperature (McMahon and Hays 2006). Should this trend continue it could lead to increased interactions between this species and offshore wind farms on the mid-Atlantic OCS, potentially magnifying the impacts and benefits described above. Over time, climate change, in combination with coastal and offshore development, would alter existing habitats, potentially rendering some areas unsuitable for certain species and more suitable for others. As described in Section 3.19.1, sea turtle populations likely to be impacted by the Project are stable or generally increasing from historic lows. Therefore, potential climate change impacts would be **minor** adverse.

Noise: Under the No Action Alternative, human activities would continue to generate underwater noise with the potential to affect sea turtles. Existing and future sources of anthropogenic underwater noise include commercial, government and military, research, and recreational vessel activity; military sonar; geophysical surveys; and the development and operation of other wind energy projects on the OCS. Several wind energy projects could be developed between 2022 to 2030, and their construction periods could overlap, adding several new sources of underwater noise to baseline levels generated by vessel traffic. As discussed in Section 2.1.3, some projects could be constructed concurrently or could involve concurrent construction activities (e.g., impact pile driving) at two or more locations in proximity, creating the potential for larger and/or overlapping areas of underwater noise effects.

Existing and potential future anthropogenic noise sources generally fall into two categories: 1) impulsive noise, defined as the instantaneous change in sound pressure over a short period of time; and 2) non-impulsive noise, which could be intermittent or remain constant and stable over a given time period. Impulsive and non-impulsive noise sources associated with offshore wind projects are discussed in the sections below.

Impulsive noise: Existing and potential future sources of impulsive underwater noise in the GAA include impact pile driving used in nearshore and offshore construction activities and geological and geophysical surveys.

Sea turtles could experience any of the following three potential exposure scenarios under the No Action Alternative:

1. Concurrent exposure to noise from two or more impact hammers, operating within the same project or in adjacent projects
2. Non-concurrent exposure to noise from multiple pile-driving events within the same year
3. Exposure to two or more concurrent or non-concurrent pile-driving events over multiple years

The reader is referred to Section 3.15 for a discussion of these concurrent noise exposure scenarios.

Geological and geophysical surveys generate high-intensity impulsive sound with the potential to result in short-term and long-term impacts on sea turtles if they are present in the ensonified area. Offshore wind surveys typically involve HRG equipment, which can generate non-impulsive noise that is generally less intense than noise generated from other geological and geophysical survey methods. Potential impacts from HRG equipment include sub-bottom profilers (e.g., boomer and sparker categories of equipment) that could be audible to sea turtles.

None of the equipment being operated for these surveys that overlaps with the hearing range (30 Hz to 2 kHz) for sea turtles has source levels loud enough to result in PTS or TTS based on the peak or cumulative exposure criteria. Therefore, physical effects are extremely unlikely to occur. Sea turtles could exhibit a behavioral response when exposed to received levels of 175 dB re 1 µPa (rms), and some HRG is within their hearing range (below 2 kHz). For boomers and bubble guns, the distance to this threshold is 40 m, and is 90 m for sparkers. Thus, a sea turtle would need to be within 90 m of the source to be exposed to potentially disturbing levels of noise. We expect that sea turtles would react to this exposure by swimming away from the sound source; this would limit exposure to a short time period—just the few seconds it would take an individual to swim away to avoid the noise. The risk of exposure to potentially disturbing levels of noise is reduced by the use of PSOs to monitor for sea turtles. At the start of a survey, equipment cannot be turned on until the clearance zone is clear for at least 30 minutes. This condition is expected to reduce the potential for sea turtles nearby to be exposed to noise that could be disturbing. However, even in the event that a sea turtle is submerged and not seen by the PSO, in the worst case, it is expected that sea turtles would avoid the area ensonified by the survey equipment that they can perceive. Because the area where increased underwater noise would be experienced is transient and increased underwater noise would only be experienced in a particular area for only seconds, BOEM expects any effects to behavior to be minor and limited to a temporary disruption of normal behaviors, temporary avoidance of the ensonified area, and minor additional energy expenditure spent while swimming away from the noisy area. If foraging or migrations are disrupted, BOEM expects that they would quickly resume once the survey vessel has left the area. No sea turtles would be displaced from a particular area for more than a few minutes. While the movements of individual sea turtles would be affected by the sound associated with the survey, these effects would be temporary (seconds to minutes) and localized (avoiding an area no larger than 90 m), and there would be only a minor and temporary impact on foraging, migrating, or resting sea turtles as the vessel continues along a survey line. Effects to individual sea turtles from brief exposure to potentially disturbing levels of noise are expected to be minor and limited to a brief startle, a short increase in swimming speed, and/or short displacement and would be so small that they cannot be meaningfully measured, detected, or evaluated; therefore, effects are negligible.

BOEM has concluded that disturbance of sea turtles from underwater noise generated by site characterization and site assessment activities would likely result in temporary displacement and other behavioral or nonbiologically significant physiological consequences (i.e., no injury or mortality would occur), and impacts on sea turtles would be negligible adverse.

Impulsive underwater noise from impact pile driving during planned offshore wind development, due to the anticipated frequency and spatial extent of effects, represents the highest likelihood for exposure of individual sea turtles to adverse impacts from noise. Although these potential impacts are acknowledged, their potential extent and magnitude is unclear because sea turtle sensitivity and behavioral responses to underwater noise are a subject of ongoing study. Potential behavioral impacts could include altered submergence patterns, temporary disturbance, startle response (diving or swimming away), and temporary displacement of feeding/migrating and a temporary stress response, if present within the ensonified area (NSF and USGS 2011; Samuel et al. 2005). The accumulated stress and energetic costs of avoiding repeated exposure to pile-driving noise over a season or a life stage could have long-term impacts on survival and fitness (Navy 2018). Conversely, sea turtles could become habituated to repeated noise exposure over time and not suffer any long-term consequences (O'Hara and Wilcox 1990; Hazel et al. 2007). This type of noise habituation has been demonstrated even when the repeated exposures were separated by several days (Bartol and Bartol 2011; Navy 2018).

Sea turtles that are close to impact pile driving could experience a temporary or permanent loss of hearing sensitivity. In theory, reduced hearing sensitivity could limit the ability to detect predators and prey or find potential mates, reducing the survival and fitness of affected individuals. However, the role and importance of hearing in these biological functions for sea turtles remain poorly understood (Lavender et al. 2014). Impacts to sea turtles from construction-related noise would likely be limited to minor or moderate short-term impacts on a small number of individuals. These short-term impacts on individuals are not expected to result in population-level effects; the effects of impulsive noise on sea turtles would therefore be **minor** adverse overall.

Non-impulsive noise: Non-impulsive underwater noise sources in the GAA include baseline noise levels from activities not regulated by BOEM, such as commercial, military and government, research, and recreational vessel traffic; aircraft; and offshore development activities. The planned development of other wind energy facilities would contribute additional new sources of intermittent non-impulsive underwater noise, including helicopters and fixed-wing aircraft, construction and O&M vessels, and vibratory pile driving during construction. Operational noise from WTGs would constitute a low-level, non-impulsive underwater noise source throughout the life of a given project.

Helicopters and fixed-wing aircraft could be used during initial site surveys, protected species monitoring prior to and during construction, and facility monitoring. Sea turtle responses to aircraft noise and disturbance is not well documented. Bevan et al. (2018) observed no evident behavioral responses from sea turtles exposed to drones flown directly overhead at altitudes ranging from 60 to 100 feet. Helicopters and aircraft would operate at altitudes of 1,000 feet or more except when helicopters are landing or departing from service vessels. In development of American National Standards Institute (ANSI) guidelines for fishes and sea turtles, Popper et al. (2014) did not consider aircraft noise because it was not considered to pose a great risk. Based on this information, cumulative effects on sea turtles from aircraft used for wind energy development on the OCS would be expected to be negligible.

Vibratory pile driving used during submarine cable construction is the most intensive source of intermittent, non-impulsive underwater noise expected to result from planned offshore wind energy development. Vibratory pile-driving noise can exceed levels associated with behavioral disturbance in sea turtles but only within a short distance (i.e., less than 200 feet) from the source. Given this low exposure probability to vibratory pile-driving noise and the fact that vibratory pile-driving activities would be limited in extent, temporary in duration, and widely separated, vibratory pile-driving noise effects on sea turtles would be negligible adverse.

Construction and operational vessels are the most broadly distributed source of intermittent non-impulsive noise associated with offshore wind projects. Sea turtle exposure to underwater vessel noise would correspondingly increase as a result of planned offshore wind projects, especially during construction periods. Applying vessel activity estimates developed by BOEM based on its 2019 study *National Environmental Policy Act Documentation for Impact-Producing Factors in the Offshore Wind Cumulative Impacts Scenario on the North Atlantic Outer Continental Shelf* (BOEM 2019b), vessel activity could peak in 2025, with as many as 276 vessels involved in the construction of reasonably foreseeable projects (see Section 2.1.3 for details). However, this increase must be considered relative to the baseline level of vessel traffic. The relatively low frequency range of turtle hearing (100–1,200 Hz) (Ketten and Bartol 2006; Lavender et al. 2014) overlaps the broad frequency spectrum of intermittent non-impulsive noise produced by vessels (10–1,000 Hz). Sea turtles could respond to vessel approach and/or noise with a startle response and a temporary stress response (NSF and USGS 2011). Overall, impacts to sea turtles from vessel noise would be negligible. Although sea turtles could become habituated to repeated noise exposure over time (Hazel et al. 2007), vessel noise effects for other wind farm development projects are expected to be broadly similar to noise levels from existing vessel traffic in the region. Nonetheless, periodic localized, intermittent, and temporary behavioral impacts on sea turtles could occur. Underwater noise generated by construction vessels would not exceed injury thresholds for turtles, as noise levels produced by vessels in general are below levels that could cause potential auditory threshold shifts. Behavioral responses to vessels have been reported but are thought to be more associated with visual cues, as opposed to auditory cues (Hazel et al. 2007), although both senses likely play a role in avoidance. A conservative assumption is that construction and support vessels could elicit behavioral changes in individual sea turtles near the vessels. It is assumed that these behavioral changes would be limited to evasive maneuvers such as diving, changes in swimming direction, or changes in swimming speed to distance themselves from vessels. Based on sea turtle responses to other types of disturbance (e.g., Bevan et al. 2018), turtle behavior is expected to return to normal when vessel noise dissipates. Given limited turtle sensitivity to underwater noise produced by vessels, the short-term nature of any behavioral responses, and the patchy distribution of sea turtles in the GAA, the effects of vessel noise from future activities on sea turtles would be negligible adverse.

Tougaard et al. (2020) summarized available monitoring data on wind farm operational noise, including both older generation geared turbine designs and quieter modern direct-drive systems like those proposed for the RWF. They determined that operating turbines produce underwater noise on the order of 110 to 125 dB_{RMS}, occasionally reaching as high as 128 dB_{RMS}, in the 10-Hz to 8-kHz range. This is consistent with the noise levels observed at the BIWF (110 to 125 dB re 1 µPa SPL rms) (Elliot et al. 2019) and the range of values observed at European wind farms and is therefore representative of the range of operational noise levels likely to occur from future wind energy projects. Sea turtle hearing is largely within the frequency range (< 1,200 Hz) for operational wind turbines; therefore, it is possible that wind turbine noise could be heard by sea turtles, although behavioral responses are unlikely based on the established threshold (175 dB_{RMS} re 1 µPa). This indicates that operational noise effects from other future actions would likely be negligible adverse.

Overall, effects of non-impulsive noise on sea turtles would be **negligible** adverse because of the patchy distribution of sea turtles and limited likelihood of behavioral responses to expected noise levels.

Presence of structures: The addition of up to 3,008 new offshore foundations in the GAA could increase sea turtle prey availability by creating new hard-bottom habitat, increasing pelagic productivity in local areas, or promoting fish aggregations at foundations (Bailey et al. 2014). The artificial reefs created by these structures form biological hotspots that could support species range shifts and expansions and changes in biological community structure (Degraer et al. 2020; Methratta and Dardick 2019; Raoux et al. 2017). Section 3.13 discusses reef creation and altered water flow in detail. The significance of these ecological changes to sea turtles is unknown, but the biological productivity generated by reef effects could result in improved foraging opportunities for some species at project scales. For example, loggerhead turtles may benefit from the increased abundance of crustaceans and other prey species concentrated around offshore structures. On this basis, the presence of structures could produce permanent **minor** beneficial effects on sea turtles that would persist over the life of the Project.

In contrast, broadscale hydrodynamic impacts could alter zooplankton distribution and abundance (van Berkel et al. 2020). There is considerable uncertainty as to how these broader ecological changes would affect sea turtles in the future and how those changes will interact with other human-caused impacts. The effect of reef effects and hydrodynamic impacts on sea turtles and their habitats under the No Action Alternative could be adverse or beneficial, varying by species, and their extent and magnitude is unknown.

The presence of structures could also concentrate recreational and commercial fishing around foundations, which could indirectly increase the potential for sea turtle entanglement in both lines and nets (Gall and Thompson 2015; Nelms et al. 2016; Shigenaka et al. 2010). Entanglement in both lines and nets could lead to injury and mortality due to abrasions, loss of limbs, and increased drag, leading to reduced foraging efficiency and ability to avoid predators (Barreiros and Raykov 2014; Gregory 2009; Vegter et al. 2014). Between 2016 and 2018, 186 sea turtles were documented as hooked or entangled with recreational fishing gear (BOEM 2021a). Due to the high number of foundations in a given lease area, it is likely that recreational and for-hire fisheries would avoid overcrowding structures by dispersing effort across many WTG foundations. However, the risk of entanglement and hooking or ingestion of marine debris could slightly increase from recreational and for-hire fishing since both fishers and turtles may be attracted to the same areas.

If structures result in vessel displacement or gear shifts, the potential impact to sea turtles is uncertain. Increased risk would not be expected by vessel displacement due to the patchy distribution of sea turtles. However, it could result in a potential increase in the number of vertical lines in the water column if there is no commensurate reduction in fixed-gear types as compared to mobile gear. In such circumstances of a greater shift from mobile gear to fixed gear, there would be a potential increase in the number of vertical lines, resulting in an increased risk of sea turtle interactions with fishing gear. Therefore, associated effects of structures on sea turtles through potential reef effects, hydrodynamic impacts, and concentration of fishing would be **minor** adverse.

<u>Vessel traffic:</u> Vessel strike is an increasing concern for sea turtles. The percentage of loggerhead sea turtles stranded with injuries consistent with vessel strikes increased from approximately 10% in the 1980s to 20.5% in 2004, although an unknown number may have been struck postmortem (NMFS and USFWS 2007). Sea turtles are expected to be most susceptible to vessel collision in shelf waters, where they forage. Furthermore, they cannot reliably avoid being struck by vessels exceeding 2 knots (Hazel et al. 2007); typical vessel speeds in the GAA could exceed 10 knots. Up to 276 vessels associated with offshore wind development could be operating in the GAA during the peak construction period in 2025. Additional fishing vessels could also be present in the vicinity due to the expected increase in fish biomass around the WTG structures. Increased vessel traffic could result in sea turtle injury or mortality; however, the proportional increase in vessel traffic from baseline would be minimal (refer to Section 3.16 and COP Appendix R [DNV GL Energy USA, Inc. 2020]). Despite the unlikely potential for individual fatalities, no population-level impacts on sea turtles are expected based on occurrence and potential exposure. Assuming other offshore wind projects employ the same minimization measures included in this Project (see Table F-1 in Appendix F), impacts would be further reduced and would be considered **negligible** to **minor** adverse.

Onshore Activities and Facilities

The construction and installation, O&M, and eventual decommissioning of onshore project facilities and related activities associated with planned and potential future offshore wind energy projects would not be expected to result in measurable impacts on the marine environment. Therefore, the onshore components of planned and future projects are likely to have no measurable effects on sea turtles and would therefore be **negligible** adverse.

3.19.1.2 Conclusions

Under the No Action Alternative, BOEM would not approve the COP; Project construction and installation, O&M, and decommissioning would not occur; and potential impacts associated with the Project to sea turtles would not occur. However, ongoing and future activities would have continuing temporary to long-term impacts on sea turtles, primarily through, but not limited to, construction-related lighting, noise, habitat alternation, collision risk, and the artificial reef effect.

Based on the current science, BOEM anticipates that the impacts of ongoing activities, especially vessel traffic, commercial and recreational fisheries gear interaction, and climate change, would be minor. In addition to ongoing activities, reasonably foreseeable activities other than offshore wind development include increased vessel traffic; new submarine cables and pipelines; channel-deepening activities; and the installation of new towers, buoys, and piers. BOEM anticipates that the impacts of reasonably foreseeable activities other than offshore wind would be minor. BOEM expects that the combination of ongoing activities and reasonably foreseeable activities other than offshore wind development to result in minor impacts on sea turtles, driven primarily by increasing vessel traffic and interactions with commercial and recreational fisheries gear.

The combined impact-level criteria in Table 3.3-2 and Table 3.3-3 in Chapter 3 are used to characterize the combined effects of all IPFs likely to occur in the GAA under the No Action Alternative. BOEM anticipates that the impacts associated with future offshore wind activities in the GAA combined with ongoing activities, reasonably foreseeable environmental trends, and reasonably foreseeable activities other than offshore wind would result in **minor** adverse impacts from construction and operational noise and exposure to vessel traffic and **minor** beneficial impacts to sea turtles from increased biological productivity created by reef effects. Those impacts would range from short term to long term in duration. Future offshore wind activities are expected to contribute considerably to several IPFs, the most prominent being the presence of structures——namely foundations, scour/cable protection, and pile-driving noise.

The No Action Alternative would forgo any monitoring that Revolution Wind has committed to perform, the result of which could provide an understanding of the effects of offshore wind development, benefit future management of sea turtles, and inform planning of other offshore developments. However, other ongoing and future surveys could provide similar data.

3.19.2 Environmental Consequences

3.19.2.1 Relevant Design Parameters, Impact-Producing Factors, and Potential Variances in Impacts

The analysis presented in this section considers the impacts resulting from the maximum-case scenario under the PDE approach developed by BOEM to support offshore wind project development (Rowe et al. 2017). The maximum design size specifications defined in Appendix D, Table D-1 are PDE parameters used to conduct this analysis. Several Project parameters could change during the development of the final Project configuration, potentially reducing the extent and/or intensity of impacts resulting from the associated IPFs.

The following design parameters would result in reduced impacts relative to those generated by the design elements considered under the PDE:

- The permitting and installation of fewer WTGs, resulting in fewer offshore structures and reduced IAC cable length. This would reduce the extent of temporary to long-term impacts on marine mammals by
  - reducing the extent and duration of underwater noise impacts from WTG foundation installation; and
  - reducing the extent of reef and hydrodynamic effects resulting from structure presence.
- The Project could use a casing pipe method to construct the RWEC sea-to-shore transition, which would result in less acoustic impact than vibratory pile driving to construct a cofferdam (Zeddies 2021).
- The use of a temporary cofferdam for RWEC sea-to-shore transition construction would reduce suspended sediment effects on sea turtles.

See Appendix E2 for a summary of IPFs analyzed for sea turtles across all action alternatives. IPFs that are either not applicable to the resource or determined by BOEM to have a negligible adverse effect are excluded from Chapter 3 and provided in Appendix E, Table E2-6.

Table 3.19-2 provides a summary of IPF findings carried forward for analysis in this section. Each alternative analysis discussion consists of the construction and installation phase, the O&M phase, the decommissioning phase, and the cumulative analysis. If these analyses are not substantially different, then they are presented as one discussion. This comparison considers the implementation of all EPMs proposed by Revolution Wind to avoid and minimize adverse impacts on sea turtles. These EPMs are summarized in Appendix F, Table F-1.

A detailed analysis of the Proposed Action is provided following the table. Detailed analysis of other considered action alternatives is also provided below the table if analysis indicates that the alternative(s) would result in substantially different impacts than the Proposed Action. Offshore and onshore IPFs are addressed separately in the analysis if appropriate for the resource; not all IPFs have both an offshore and onshore component. Where feasible, calculations for specific alternative impacts are provided in Appendix E4, to facilitate reader comparison across alternatives.

The conclusion section within each alternative analysis discussion includes rationale for the overall effect determination. Overall impacts associated with the each alternative would result in **minor** adverse impacts on sea turtles in the GAA because unavoidable adverse impacts on individual sea turtles could occur, but those impacts are unlikely to measurably affect the viability of any sea turtle species at the population level.

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Table 3.19-2. Alternative Comparison Summary for Sea Turtles

Impact-Producing Factor	No Action Alternative	Alternative B (Proposed Action) Up to 100 WTGs	Alternative C (Habitat Alternative) 64 or 65 WTGs	Alternative D (Transit Alternative) 78 to 93 WTGs	Alternative E (Viewshed Alternative) 64 or 81 WTGs	Alternative F (Higher Capacity Turbine Alternative) 56 WTGs
Accidental releases and discharges	**Offshore**: While marine vessels are an inherent source of accidental releases of trash, debris, and contaminants, existing regulatory requirements would effectively avoid and minimize these impacts such that the resulting effects to sea turtles would be **negligible** adverse. All future offshore wind projects would be required to comply with regulatory requirements related to the prevention and control of accidental spills administered by the USCG and the BSEE Oil spill response plans are required for each project and would provide for rapid spill response, clean-up, and other measures that would help to minimize potential impacts on affected resources. Given the low probability of a large spill event, impacts to sea turtles are likely to be **negligible** adverse.	**Offshore**: BOEM prohibits the discharge or disposal of solid debris into offshore waters during any activity associated with the construction and operation of offshore renewable energy facilities (30 CFR 585.105(a)). The USCG similarly prohibits the dumping of trash or debris capable of posing entanglement or ingestion risk (MARPOL, Annex V, Public Law 100–220 (101 Stat. 1458)). The Project would comply with these requirements (Jacobs 2020). Given these restrictions, the short-term impacts to sea turtles from trash and debris from the Project would be **negligible** adverse. Project EPMs, permit requirements, controls, and procedures would be implemented as part of the Project to reduce the potential or extent of offshore spills, thereby avoiding or minimizing impacts on water quality. Should a spill occur, response and containment procedures would limit the reach of the spill to a localized area, where changes to water quality would be detectable and would exceed water quality standards. Given the low potential for spills and minimal risk of exposure to small temporary spills, the risk from construction-related spills is **negligible** to **minor** adverse. Impacts on sea turtles from accidental spills or releases of pollutants are considered **minor** adverse during O&M because of the low probability of the risk and EPMs. Cumulative impacts associated with the Project when combined with past, present, and reasonably foreseeable future activities would be **negligible** to **minor** adverse because of the regulatory protections and limited likelihood of sea turtle exposure.	**Offshore:** Effects on sea turtles from accidental releases and discharges under Alternatives C through F would be similar to those described for the Proposed Action. Alternatives C through F would include the same EPMs to avoid and minimize impacts to sea turtles from accidental releases and discharges. Effects on sea turtles would therefore be **negligible** adverse and short term. While unlikely, vessels collision or allisions could occur during Project construction, presenting the potential risk of larger spills, potentially harmful to sea turtles. Alternatives C through F would slightly reduce total chemical and lubricant uses relative to the Proposed Action, but this effect would be small in comparison to projected chemical use on the mid-Atlantic OCS. When combined with other offshore wind projects, up to approximately 19 million gallons of coolants, fuels, oils, and lubricants could cumulatively be stored within WTG foundations and OSSs. However, all future offshore energy development projects would comply with BOEM and USCG regulations that prohibit dumping of trash and debris and require measures to avoid and minimize accidental spills. Cumulative impacts associated with the Habitat Alternative when combined with past, present, and reasonably foreseeable future activities would be **negligible** to **minor** adverse.			
	Onshore: The construction and installation, O&M, and eventual decommissioning of onshore project facilities and related activities associated with planned and potential future offshore wind energy projects would not be expected to result in measurable impacts on the marine environment. Therefore, the onshore components of planned and future projects are likely to have no measurable effects on sea turtles and would therefore be **negligible** adverse.	**Onshore:** Construction of onshore Project facilities and associated activities would not result in measurable impacts on the marine environment. Therefore, onshore activities and facilities would have no measurable effect on sea turtles and would therefore be **negligible** adverse.	**Onshore:** Onshore Project activities would not result in impacts to marine resources regardless of alternative. Therefore, impacts of onshore activities to sea turtles would be the same as those for the No Action Alternative: **negligible** adverse.			
Climate change	**Offshore**: Over time, climate change, in combination with coastal and offshore development, would alter existing habitats, potentially rendering some areas unsuitable for certain species and more suitable for others. However, sea turtle populations likely to be impacted by the Project are stable or generally increasing from historic lows. Therefore, potential climate change impacts would be **minor** adverse.	**Offshore**: Northward shifts in sea turtle distributions due to warming waters could result in magnification of the anticipated impacts due to increased exposure. However, this magnification includes potential benefits associated with the creation of artificial reef habitat and could represent an increasing impact over the life of the Project. Therefore, the Proposed Action when combined with other past, present, and reasonably foreseeable actions is expected to result in **minor** adverse cumulative impacts to sea turtles due to the anticipated shifts in distributions.	**Offshore:** The types of impacts from global climate change described for the No Action Alternative would occur under Alternatives C through F, but as with the Proposed Action, this alternative could also contribute to a long-term net decrease in GHG emissions.However, northward shifts in sea turtle distributions due to warming waters could result in magnification of the anticipated impacts due to increased exposure. This magnification includes potential benefits associated with the creation of artificial reef habitat and could represent an increasing impact over the life of the Project. Therefore, Alternatives C through F when combined with other past, present, and reasonably foreseeable actions and ongoing environmental trends is expected to result in **minor** adverse cumulative impacts to sea turtles.			
	Onshore: The construction and installation, O&M, and eventual decommissioning of onshore project facilities and related activities associated with planned and potential future offshore wind energy projects would not be expected to result in measurable impacts on the marine environment. Therefore, the onshore components of planned	**Onshore:** Construction of onshore Project facilities and associated activities would not result in measurable impacts on the marine environment. Therefore, onshore activities and facilities would have no measurable effect on sea turtles and would therefore be **negligible** adverse.	**Onshore:** Onshore Project activities would not result in impacts to marine resources regardless of alternative. Therefore, impacts of onshore activities to sea turtles would be the same as those for the No Action Alternative: **negligible** adverse.			

Impact-Producing Factor	No Action Alternative	Alternative B (Proposed Action) Up to 100 WTGs	Alternative C (Habitat Alternative) 64 or 65 WTGs	Alternative D (Transit Alternative) 78 to 93 WTGs	Alternative E (Viewshed Alternative) 64 or 81 WTGs	Alternative F (Higher Capacity Turbine Alternative) 56 WTGs
	and future projects are likely to have no measurable effects on sea turtles and would therefore be **negligible** adverse.					
Noise	**Offshore**: Under the No Action Alternative, human activities would continue to generate underwater noise with the potential to affect sea turtles. These short-term impacts on individuals are not expected to result in population-level effects; the effects of impulsive noise on sea turtles would therefore be **minor** adverse, while effects of non-impulsive noise on sea turtles would be **negligible** adverse because of the patchy distribution of sea turtles and limited likelihood of behavioral responses to expected noise levels.	**Offshore**: A temporary increase in underwater noise could impact sea turtles if they are present in the area during the time of RWF and offshore RWEC construction. Sea turtles that are close to impact pile driving could experience a temporary or permanent loss of hearing sensitivity. Sea turtles could also respond to vessel approach and/or noise with a startle response and a temporary stress response. Based on the combination of minimization measures and the low numbers of sea turtles expected in the RWF and RWEC, however, impacts to sea turtles from impact pile driving are expected to be **negligible** to **minor** adverse and impacts to sea turtles from vessel noise would be **negligible** adverse. Likewise, underwater noise impacts from HRG surveys are expected to be **minor** adverse and aircraft noise impacts sea turtles are expected to be **negligible** adverse because exposures would be limited in extent and temporary in duration. Project decommissioning would require the use of construction vessels of similar number and class as those used during construction, and would therefore range from **negligible** to **minor** adverse. Sea turtle hearing is largely within the frequency range (< 1,200 Hz) of operational wind turbines; therefore, it is possible that wind turbine noise could be heard by sea turtles, although behavioral responses are unlikely based on the established threshold, resulting in **negligible** adverse effects. Based on the above findings, noise-related impacts of the Proposed Action when combined with past, present, and reasonably foreseeable projects would result in **negligible** to **minor** adverse cumulative impacts to sea turtles, depending upon the noise source.	**Offshore:** See Section 3.19.2.3.1 for construction analysis. Alternatives C through F would include the same, or similar, operational and decommissioning noise-producing activities as those described for the Proposed Action but would be reduced based on the reduction in the number of WTGs and other operational elements. Thus, the impacts of operational and cumulative noise are also considered **negligible** to **minor** adverse.			
	Onshore: The construction and installation, O&M, and eventual decommissioning of onshore project facilities and related activities associated with planned and potential future offshore wind energy projects would not be expected to result in measurable impacts on the marine environment. Therefore, the onshore components of planned and future projects are likely to have no measurable effects on sea turtles and would therefore be **negligible** adverse.	**Onshore:** Construction of onshore Project facilities and associated activities would not result in measurable impacts on the marine environment. Therefore, onshore activities and facilities would have no measurable effect on sea turtles and would therefore be **negligible** adverse.	**Onshore:** Onshore Project activities would not result in impacts to marine resources regardless of alternative. Therefore, impacts of onshore activities to sea turtles would be the same as those for the No Action Alternative: **negligible** adverse.			

Impact-Producing Factor	No Action Alternative	Alternative B (Proposed Action) Up to 100 WTGs	Alternative C (Habitat Alternative) 64 or 65 WTGs	Alternative D (Transit Alternative) 78 to 93 WTGs	Alternative E (Viewshed Alternative) 64 or 81 WTGs	Alternative F (Higher Capacity Turbine Alternative) 56 WTGs
Presence of structures	**Offshore**: The addition of up to 3,008 new offshore foundations in the GAA could increase sea turtle prey availability by creating new hard-bottom habitat, increasing pelagic productivity in local areas, or promoting fish aggregations at foundations (Bailey et al. 2014). In contrast, broadscale hydrodynamic impacts could alter zooplankton distribution and abundance and concentrate recreational and commercial fishing around foundations, which could indirectly increase the potential for sea turtle entanglement in both lines and nets. Therefore, associated effects of structures on sea turtles through potential reef effects, hydrodynamic impacts, and concentration of fishing would be **minor** adverse, offset by **minor** beneficial impacts to sea turtle species that benefit from reef effects.	**Offshore**: Construction and installation of offshore structures would have temporary **negligible** to **minor** adverse effects on sea turtles, varying in significance by species, due to underwater noise impacts related to impact pile driving and noise and disturbance from associated vessel activity. Potential long-term, intermittent impacts could persist until decommissioning is complete and structures are removed. These O&M impacts would be **negligible** to **minor** adverse, offset by **minor** beneficial impacts to sea turtle species that benefit from reef effects. BOEM estimates a cumulative total of 3,110 offshore WTGs and OSS foundations for the Proposed Action plus all other future offshore wind projects in the GAA. For similar reasons as described above, the Proposed Action when combined with past, present, and reasonably foreseeable projects would result in **negligible** to **minor** adverse cumulative impacts and potential **minor** beneficial cumulative impacts to sea turtles.	**Offshore**: Alternatives C through F would result in impacts to sea turtles associated with the presence of WTG and OSS foundations that are similar to those described for the Proposed Action, but those effects would be reduced in extent. This would reduce the extent of long-term impacts on benthic habitat, water flow, prey aggregation, and fishing activity. This would also reduce the extent of antcipated hydrodynamic and reef effects. But given the offsetting nature of anticipated effects, the differences between alternatives on sea turltes would be uncertain. As with the Proposed Action, the overall impact to sea turtles from the presence of structures is not expected to be biologically significant due to the patchy distribution of sea turtles within the RWF and RWEC. Indirect effects on the prey base of some sea turtle species (i.e., invertebrates) from the presence of structures would occur. Potential long-term, intermittent impacts would persist until decommissioning is complete and structures are removed. These impacts would be **negligible** to **minor** adverse, offset by **minor** beneficial impacts to sea turtle species that benefit from reef effects.			
	Onshore: The construction and installation, O&M, and eventual decommissioning of onshore project facilities and related activities associated with planned and potential future offshore wind energy projects would not be expected to result in measurable impacts on the marine environment. Therefore, the onshore components of planned and future projects are likely to have no measurable effects on sea turtles and would therefore be **negligible** adverse.	**Onshore:** Construction of onshore Project facilities and associated activities would not result in measurable impacts on the marine environment. Therefore, onshore activities and facilities would have no measurable effect on sea turtles and would therefore be **negligible** adverse.	**Onshore:** Onshore Project activities would not result in impacts to marine resources regardless of alternative. Therefore, impacts of onshore activities to sea turtles would be the same as those for the No Action Alternative: **negligible** adverse.			

Impact-Producing Factor	**No Action Alternative**	**Alternative B (Proposed Action) Up to 100 WTGs**	**Alternative C (Habitat Alternative) 64 or 65 WTGs**	**Alternative D (Transit Alternative) 78 to 93 WTGs**	**Alternative E (Viewshed Alternative) 64 or 81 WTGs**	**Alternative F (Higher Capacity Turbine Alternative) 56 WTGs**
Vessel traffic	**Offshore**: Increased vessel traffic could result in sea turtle injury or mortality; however, the proportional increase in vessel traffic from baseline would be minimal. Despite the unlikely potential for individual fatalities, no population-level impacts on sea turtles are expected based on occurrence and potential exposure. Assuming other offshore wind projects employ similar minimization measures included in this Project (see Table F-1 in Appendix F), impacts would be further reduced and would be considered **negligible** to **minor** adverse.	**Offshore**: Vessel collisions with individual turtles could occur, resulting in mortalities. Because the abundance of sea turtles is anticipated to be generally low with patchy distribution, and the proportional increase in vessel traffic is also low, the number of sea turtles injured or killed by vessel strikes during Project construction would be low and would have negligible effects at the population level. Therefore, the potential effects of construction and decomissioning vessel collisions on sea turtles would be **minor** adverse. O&M vessel use would represent a minimal increase in regional vessel traffic over the life of a facility and the effects to sea turtles are expected to be **negligible** to **minor** adverse. An increase in vessel traffic poses an increased likelihood of collision-related injury and mortality relative to existing baseline conditions. Some sea turtles could be injured or killed as a result, but the number of individuals impacted is not likely to significantly increase the existing mortality rate from vessel strikes. Additionally, BOEM expects that similar EPMs will be included in future offshore wind projects, helping to minimize the vessel strike risk. Therefore, cumulative impacts associated with the Project when combined with past, present, and reasonably foreseeable future activities would be **minor** adverse; BOEM does not expect the viability of sea turtle populations to be affected.	**Offshore:** Alternative C to F would require the same types and number of construction O&M and decommissioning vessels producing the similar impacts to those described for the Proposed Action, but the number of vessel trips and overall duration of construction activity would be reduced. The risk of collisions, disturbance, and other associated effects on sea turtles would similarly be reduced consistent with the overall reduction in vessel trips required to construct each alternative configuration. Thus, vessel traffic associated with the RWF would be expected to increase less than the 2.1% per year across transects 13–17 (see Figure 3.15-2) estimated for the Proposed Action. For the Proposed Action, Revolution Wind (Tech Environmental 2021) has estimated that Project O&M would involve up to four CTV and two SOV trips per month for wind farm O&M, or 2,280 vessel trips over the life of the Project. It can be assumed that the Transit Alternative would require similar or slightly fewer vessel trips during O&M. Sea turtles are likely to be most susceptible to vessel collision in coastal foraging areas crossed by construction vessels traveling between the RWF and offshore RWEC and area ports. Hazel et al. (2007) indicated that sea turtles may not be able to avoid being struck by vessels at speeds exceeding 2 knots, and collision risk increases with increasing vessel speed. Habituation to noise may also increase the risk of vessel collision. However, avoidance behaviors observed suggest that a turtle's ability to detect an approaching vessel is more dependent on vision than sound, although both may play a role in eliciting behavioral responses. Project EPMs include the implementation of NOAA vessel guidelines (see Appendix F) for marine mammal and sea turtle strike avoidance measures, including vessel speed restrictions. Nevertheless, collisions with individual turtles could occur, resulting in mortalities. Because the abundance of sea turtles is anticipated to be generally low with patchy distribution, and the proportional increase in vessel traffic is also low, the number of sea turtles injured or killed by vessel strikes during Project construction would be low and would have negligible effects at the population level. O&M vessel use would represent a minimal increase in regional vessel traffic over the life of the Project and, as detailed in the EPMs listed in Table F-1 in Appendix F, all survey vessels would comply with speed restrictions and other minimization measures to minimize risk of collision with sea turtles, making the risk of vessel strikes from Project monitoring vessels unlikely. Therefore, the potential effects of vessel collisions on sea turtles would **negligible** to **minor** adverse for the life of the Project; BOEM does not expect the viability of sea turtle populations to be affected.			
	Onshore: The construction and installation, O&M, and eventual decommissioning of onshore project facilities and related activities associated with planned and potential future offshore wind energy projects would not be expected to result in measurable impacts on the marine environment. Therefore, the onshore components of planned and future projects are likely to have no measurable effects on sea turtles and would therefore be **negligible** adverse.	**Onshore:** Construction of onshore Project facilities and associated activities would not result in measurable impacts on the marine environment. Therefore, onshore activities and facilities would have no measurable effect on sea turtles and would therefore be **negligible** adverse.	**Onshore:** Onshore Project activities would not result in impacts to marine resources regardless of alternative. Therefore, impacts of onshore activities to sea turtles would be the same as those for the No Action Alternative: **negligible** adverse.			

3.19.2.2 Alternative B: Impacts of the Proposed Action on Sea Turtles

3.19.2.2.1 Construction and Installation

Offshore Activities and Facilities

Construction impacts to sea turtles could occur from accidental releases and discharges, artificial lighting, seafloor disturbance, entrainment and impingement, underwater and airborne noise, vessel traffic (strikes and noise), and water quality degradation. The potential for these impacts to occur are discussed in detail by IPF.

Accidental releases and discharges: During construction of the RWF and RWEC, there could be a short-term risk of sanitary and other waste fluids or fuels and other petrochemicals accidentally entering the water. If sea turtles were to be exposed to an oil spill or a discharge of waste material, studies indicate that respiration, skin, some aspects of blood chemistry and composition, and salt gland function could be significantly impacted in exposed individuals (Vargo et al. 1986). Any nonroutine spills or accidental releases that could result in negligible and short-term impacts to surface water resources would be avoided or minimized through the implementation of the Project SPCC plan and other EPMs (see Table F-1 in Appendix F). Impacts on sea turtles from accidental spills or releases of pollutants are considered negligible because of the low probability of the risk and EPM implementation.

Trash and debris that enter the water represent a risk factor to sea turtles because the turtles could ingest or become entangled in debris, causing lethal or injurious impacts. Pollution (e.g., plastic) is often mistaken for food such as jellyfish and ingested, which can block intestinal tracts, causing injury or mortality. See Section 3.15.2 for additional debris and entanglement analysis. Personnel working offshore would receive training on sea turtle and marine debris awareness. Impacts on sea turtles from accidental deposits of trash or debris associated with RWF are considered minor because implementation of proposed EPMs would lower the probability of such risk.

BOEM prohibits the discharge or disposal of solid debris into offshore waters during any activity associated with the construction and operation of offshore energy facilities (30 CFR 585.105(a)). The USCG similarly prohibits the dumping of trash or debris capable of posing entanglement or ingestion risk (MARPOL, Annex V, Public Law 100−220 (101 Stat. 1458)). The Project would comply with these requirements (Jacobs 2020). Given these restrictions, the short-term impacts to sea turtles from trash and debris from the Project would be **negligible** adverse.

Construction vessels also pose a potential risk for Project-related accidental spills. As described in Section 3.21.2.2.1, the chance of a spill occurring due to vessel allisions or collisions would be low (once per 1,000 years). In the unlikely event an allision or collision involving Project vessels or components resulted in a high-volume spill, impacts on water quality would be minor to moderate adverse and temporary to long term, depending on the type and volume of material released and the specific conditions (e.g., depth, currents, weather conditions) at the location of the spill. Project EPMs, permit requirements, controls, and procedures would be implemented as part of the Project to reduce the potential or extent of offshore spills, thereby avoiding or minimizing impacts on water quality. Should a spill occur, response and containment procedures would limit the reach of the spill to a localized area, where changes to water quality would be detectable and would exceed water quality standards. Given the low potential for spills and minimal risk of exposure to small temporary spills, the risk from construction-related spills is **negligible** to **minor** adverse.

Noise: A temporary increase in underwater noise is the most likely construction-related factor that could impact sea turtles if they are present in the area during the time of RWF and offshore RWEC construction. Construction noise sources include impact and vibratory pile driving, UXO detonation, HRG surveys, construction vessels, and helicopters and fixed-wing aircraft.

The current literature and effect analysis guidance regarding sensitivity to underwater noise effects vary depending on the source. Popper et al. (2014) reviewed available data and suggested the threshold levels of 207 peak decibels (dB re 1 µPa) and 210 decibels referenced to the sum of cumulative pressure in micropascals squared, normalized to 1 second (dB re 1 μPa^2s) for injurious (i.e., hearing loss) underwater noise for sea turtles. These recommended criteria are for mortality and potential mortal injury. NMFS has considered injury onset for PTS (i.e., permanent hearing injury) beginning at 232 dB re 1 µPa and 204 dB re 1 μPa^2s and TTS (i.e., a temporary and recoverable loss of hearing sensitivity) beginning at 226 peak dB re 1 µPa and 189 cumulative dB re 1 μPa^2s (Navy 2017). Exposure modeling for the extent of injurious effects from impulsive underwater noise was completed by Kusel et al. (2021) using the Navy (2017) thresholds, including a behavioral response SPL threshold of 175 rms dB re 1 µPa. These thresholds apply to juvenile, subadult, and adult life stages.

Table 3.19-3 summarizes thresholds for underwater noise effects and the maximum distances to injurious and behavioral effects from construction-related underwater noise levels from construction-related activities, including impact pile driving (Kusel et al. 2021), UXO detonation (Hannay and Zykov 2021), and HRG surveys (BOEM 2021b). These effects are described in greater detail below.

Table 3.19-3. Distances to Sea Turtle Underwater Noise Injury and Behavioral Thresholds for Wind Turbine Generator and Offshore Substation Foundation Installation

Activity†	Number of Sites	Total Days	Noise Exposure Type	Exposure Threshold*	Range of Threshold Distances (feet)‡
12-m WTG monopile foundation installation	100	33	Peak injury	232	–
			Cumulative Injury	204	98–689
			Behavioral or TTS	175	1,903–2,920
15-m OSS monopile foundation installation	2	2	Peak injury	232	–
			Cumulative Injury	204	0–820
			Behavioral or TTS	175	2,362–3,182
Temporary cofferdam installation	1	14	Cumulative injury	210	102
			Behavioral or TTS	189	174

Activity†	Number of Sites	Total Days	Noise Exposure Type	Exposure Threshold*	Range of Threshold Distances (feet)‡
UXO detonation	13	13	Injury	204	207–1,699
			TTS	189	354–8,235
HRG surveys	10,755	248	Behavioral	189	0–300
Construction vessel operation	N/A	~730	Behavioral or TTS	189	–

* Peak injury thresholds are SPL in dB re 1 µPa; cumulative injury thresholds are frequency-weighted SEL in dB re 1 $\mu Pa^2 \cdot s$ based on 24 hours of continuous exposure. The peak injury threshold is not recommended for estimating risk of injury from UXO detonation (Hannay and Zykov 2021).

† Installation scenario for 12-m monopile is 6,500 strikes/pile at installation rate of three piles/day. Installation scenario for 15-m monopile is 11,500 strikes/pile at installation rate of one pile/day. All piles installed with a 4,000-kJ hammer with an attenuation system achieving 10 dB sound source reduction. Sound source scenario for UXOs assumes detonation of thirteen 1,000-pound explosives with 10 dB of sound source attenuation.

‡ Pile-driving values are maximum threshold distances modeled by Kusel et al. (2021) for winter conditions. UXO detonation values are the range of maximum distances modeled by Hannay and Zykov (2021) for 5- to 1,000-pound explosive devices. Both sets of values assume 10 dB of sound attenuation.

As shown in Table 3.19-3, impact pile driving and UXO detonation produce sufficient underwater noise to cause permanent hearing injury and behavioral effects on sea turtles. The combined impact area for pile driving is sufficiently large that the potential for hearing injury to some sea turtles cannot be discounted. Orsted anticipates that up to 13 UXOs ranging from 5 to 1,000 pounds in size may need to be detonated in place (LGL 2022). The number, size, and distribution of UXOs potentially occurring in the Maximum Work Area is not currently known, but the largest devices are most likely to be found within the central portion of the RWF and on the RWEC corridor in state waters at the mouth of and outside of Narragansett Bay (Ordtek 2021). The extent and duration of exposure to potential injury-level effects from UXO detonation is relatively small in comparison to pile driving. This suggests that even under the maximum impact scenario considered in this analysis, the risk of permanent hearing injury to sea turtles is relatively low.

Little is known about the role of sound perception in the sea turtle's typical activities. Although sea turtles have relatively unspecialized ears relative to other vertebrate species, their auditory organs appear to be specifically adapted to underwater hearing (Dow Piniak et al. 2012). Studies indicate that hearing in sea turtles is confined to lower frequencies, below 1,200 Hz, with the range of highest sensitivity between 100 and 700 Hz (Dow Piniak et al. 2012), with some variation between species (Bartol and Ketten 2006; Dow Piniak et al. 2012; Martin et al. 2012; Piniak et al. 2016). In captive enclosures and during NSF-funded at-sea seismic monitoring programs, sea turtles generally respond to seismic survey sound with behavioral changes such as startling, increasing swimming speed, and swimming away from and/or locally avoiding the source (McCauley et al. 2000; NSF and USGS 2011). The majority of pile-driving activities are expected to take place during daylight hours. However, pile driving could occur at any time night under specific circumstances.[3] Sea turtles migrating through the area when pile driving occurs are

[3] Installation of each foundation pile would begin during daylight hours with the intent of completion before dark. However, in certain circumstances the installation process may be delayed or take longer than anticipated. This may require continuing impact pile driving after dark if the installation must be completed for safety purposes and/or to ensure structural stability.

expected to adjust their course to avoid the area where noise is elevated above 175 dB re 1 μPa. Depending on how close the individual is to the pile being driven, this could involve swimming a mile or more to avoid stressful noise levels. Such behavioral alterations could cause turtles to cease foraging or expend additional effort and energy avoiding the area. Presumably, turtles could continue foraging activities outside the area of elevated noise levels as adjacent habitat provides similar foraging opportunities. The sea turtle may experience physiological stress during this avoidance behavior, but this stressed state would be anticipated to dissipate over time once the turtle is outside the ensonified area. Either a temporary or permanent reduction in hearing sensitivity could be harmful for sea turtles, but the potential extent and magnitude is unclear because the role that hearing plays in sea turtle survival (e.g., for predator avoidance, prey capture, and navigation) is poorly understood (NSF and USGS 2011). The use of PSOs, exclusion and monitoring zones, and pile-driving soft start measures (see Table F-1 in Appendix F) would minimize the risk of sea turtle exposure to elevated underwater noise levels. The efficacy of exclusion and monitoring zones would be less during periods of nighttime pile driving, potentially exposing more individuals to elevated underwater noise.

Foraging disruptions due to displacement would be temporary and are not expected to last longer than a few hours per day when pile driving occurs. This displacement would result in a relatively small energetic consequence that would not be expected to have long-term impacts on sea turtles. Construction activities could temporarily displace animals into areas that have a lower foraging quality or result in higher risk of interactions with ships or fishing gear. However, the duration of disturbance is limited to active pile driving (i.e., approximately 220 and 380 minutes per WTG and OSS monopile, respectively), and individuals could become habituated to repeated exposures over time and ignore a stimulus that was not accompanied by an overt threat (Hazel et al. 2007).

Impact pile driving during construction is the loudest potential impulsive underwater noise source associated with the Project and would produce the most extensive effects. As discussed in Section 3.19.1.1, the potential significance of impulsive underwater noise is unclear because sea turtle sensitivity and behavioral responses to underwater noise are a subject of ongoing study. Potential behavioral impacts could include altered submergence patterns, temporary disturbance, startle response (diving or swimming away), and temporary displacement of feeding/migrating and a temporary stress response, if present within the ensonified area (NSF and USGS 2011; Samuel et al. 2005). The accumulated stress and energetic costs of avoiding repeated exposure to pile-driving noise over a season or life stage could have long-term impacts on survival and fitness (Navy 2018). Conversely, sea turtles could become habituated to repeated noise exposure over time and not suffer long-term consequences (O’Hara and Wilcox 1990). This type of noise habituation has been demonstrated even when the repeated exposures were separated by several days (Bartol and Bartol 2011; Navy 2018).

Kusel et al. (2021) developed estimates of the number of sea turtles that could be exposed to potential adverse noise-related effects from WTG and OSS foundation installation. They used a sophisticated exposure model to estimate the number of individuals by species that could be exposed to PTS, TTS, and other temporary physiological and behavioral effects from construction noise exposure. The analysis used a conservative construction schedule in which the WTG and OSS installation was concentrated during the highest density months for each species, with up to three piles per day for 30 days. Based on the established timing restrictions to protect marine mammal species (i.e., NARWs), construction would occur primarily during the summer months when sea turtles (especially loggerheads and leatherbacks) have a higher likelihood of being present. The density estimates supporting the analysis are therefore likely representative of densities when construction activities would occur. The exposure estimates presented in Table 3.19-4 assume a broadband attenuation of 10 dB and a Project construction duration of approximately 35 days, assuming an aggressive installation schedule of three WTG and one OSS foundations per day.

Hannay and Zykov (2022) used a similar model to estimate the threshold distances for PTS and TTS exposure from UXO detonation. Turtles within 689 feet of UXO detonation could experience injury based on the threshold of 210 dB re 1 $\mu Pa^2 s$. Turtles within 1,699 feet exposed to multiple UXO detonations in a single day could experience accumulated injury from based on the 204 dB SEL dB re 1 $\mu Pa^2 s$. Turtles within 8,235 feet of UXO detonation could experience behavioral impacts based on the threshold of 189 dB re 1 $\mu Pa^2 s$. The UXO detonation plan would include the same or similar sound attenuation, PSOs, and site clearance EPMs used for pile driving (see Table F-1, Appendix F) to avoid and minimize adverse impacts to sea turtles. These exposure estimates do not consider the benefits to sea turtles from avoiding accidental uncontrolled UXO detonations that could occur in the absence of the Project. Zykov (2022) developed an exposure model to estimate the number of individuals by species that could be exposed to PTS and TTS from UXO detonation. The exposure scenario for UXOs assumes that thirteen 1,000-pound devices would require detonation within the RWF and RWEC work areas and that the devices are distributed such that the exposure areas would not overlap. Zykov (2022) determined that less than one individual leatherback and less than one individual loggerhead sea turtle could be exposed to PTS or TTS effects from UXO detonation in the RWEC corridor, and none would be exposed to these effects from detonations in the RWF. No Kemp's Ridley or green sea turtles are likely to be exposed to PTS or TTS effects in either area.

Table 3.19-4. Estimated Number of Sea Turtles Experiencing a Permanent Threshold Shift and Temporary Threshold Shift or Behavioral Effects from Construction-Related Impact Pile Driving

<table>
<tr><th>Species</th><th>Source</th><th>PTS Cumulative Sound Exposure (number of indivuals)</th><th colspan="2">PTS from Peak Sound Pressure Exposure (number of indivuals)</th><th>TTS or Behavioral Effects (number of indivuals)</th><th>Effect Significance*</th></tr>
<tr><td rowspan="2">Kemp’s ridley turtle</td><td>Impact pile driving</td><td>< 0.01</td><td colspan="2">0</td><td rowspan="2">< 1</td><td rowspan="2">Negligible</td></tr>
<tr><td>UXO detonation</td><td>--</td><td>0</td><td>0</td></tr>
<tr><td rowspan="2">Leatherback turtle</td><td>Impact pile driving</td><td>< 1</td><td colspan="2">0</td><td rowspan="2">8</td><td rowspan="2">Minor</td></tr>
<tr><td>UXO detonation</td><td>--</td><td>< 1</td><td>< 1</td></tr>
<tr><td rowspan="2">Loggerhead turtle</td><td>Impact pile driving</td><td>< 1</td><td colspan="2">0</td><td rowspan="2">4</td><td rowspan="2">Minor</td></tr>
<tr><td>UXO detonation</td><td>--</td><td>< 1</td><td>< 1</td></tr>
<tr><td rowspan="2">Green turtle[†]</td><td>Impact pile driving</td><td>< 0.01</td><td colspan="2">0</td><td rowspan="2">< 1</td><td rowspan="2">Negligible</td></tr>
<tr><td>UXO detonation</td><td>--</td><td>0</td><td>0</td></tr>
</table>

Source: Kusel et al. (2021), Zykov (2022)

Note: Modeled exposure estimates based on impact hammer installation of one hundred 12-m and two 15-m monopiles. Installation scenario assumes use of a noise attenuation system achieving 10-dB effectiveness. Values < 1 indicate a modeled exposure estimate of greater than 0 but less than 0.5 affected individual, which is considered a result of zero for regulatory purposes.

* See impact significance criteria definitions in Chapter 3, Table 3.3-2.

[†] Kraus et al. (2016) did not observe any green sea turtles in the RI/MA WEA. Densities of Kemp’s ridley sea turtles are used as a conservative estimate.

Sea turtles that are close to impact pile driving could experience a temporary or permanent loss of hearing sensitivity. However, the potential effects on sea turtles are reduced through the implementation of EPMs and additional minimization measures (see Appendix F), including PSOs, soft starts, and noise attenuation systems. Reduced hearing sensitivity could limit the ability to detect predators and prey or find potential mates, reducing the survival and fitness of affected individuals, but the role and importance of hearing in these biological functions for sea turtles remain poorly understood (Lavender et al. 2014). Based on the combination of minimization measures and the low numbers of sea turtles expected in the RWF and RWEC, impacts to sea turtles from impact pile driving are expected to be **negligible** to **minor** adverse.

Vibratory pile driving could be used to install cofferdams for the RWEC sea-to-shore transition at Quonset Point. Similar to the effects of the impulsive impact hammer, only minor impacts to sea turtles from vibratory pile driving are expected because of the combination of minimization measures used and the low densities of sea turtles in the RWF and RWEC. Noise from vibratory pile driving at the sea-to-shore transition would be constrained within the natural geography of Narragansett Bay. Vibratory pile-driving noise is unlikely to exceed recommended sea turtle injury thresholds and would only exceed behavioral thresholds within 175 feet of the source (BOEM 2021a). Given the limited spatial extent of these potential effects, sea turtles are more likely to respond to disturbance from construction vessels staging on-site before pile driving begins. This suggests that the potential for exposure to vibratory pile-driving noise is limited at best, with vessel noise and disturbance being the more likely source of potential behavioral effects.

HRG surveys use a combination of sonar-based methods to map shallow geophysical features. Up to 10,755 linear miles of preconstruction surveys would be conducted to support Project installation. The equipment is towed behind a moving survey vessel attached by an umbilical cable. HRG equipment operating at frequencies below 2,000 Hz (typically sub-bottom profilers) may be audible to sea turtles. Equipment such as echosounders and side-scan sonars operate at higher frequencies andwould be outside the hearing range of sea turtles,therefore having no effect on these species. The equipment only operates when the vessel is moving along a survey transect, meaning that the ensonified area is intermittent and constantly moving. BOEM (2021b) evaluated evaluated potential underwater noise effects on sea turtles from HRG surveys and concluded there is no possibility of PTS in sea turtles from HRG sound sources because of the brief and intermittent disturbances that a vessel could have on individuals. Some HRG survey noise sources would exceed the behavioral effects threshold up to 300 feet from the source, depending on the type of equipment used, but given the limited extent of potential noise effects and the EPMs used in this Project (e.g., soft start measures, shutdown procedures, protected species monitoring protocols, use of qualified and NOAA-approved PSOs, and noise attenuation systems), adverse impacts to sea turtles are unlikely to occur. While low-level behavioral exposures could occur, these would be limited in extent and temporary in duration (BOEM 2021b). Therefore, underwater noise impacts from HRG surveys are expected to be **minor** adverse.

The relatively low frequency range of turtle hearing (100–1,200 Hz) (Ketten and Bartol 2006; Lavender et al. 2014) overlaps the broad frequency spectrum of noise produced by vessels (10–1,000 Hz). Sea turtles could respond to vessel approach and/or noise with a startle response and a temporary stress response (NSF and USGS 2011). However, Hazel et al. (2007) suggested that turtles could habituate to vessel sounds in marine areas that experience regular vessel traffic. This could reduce the behavioral impacts of vessel noise but could increase the potential for vessel collision (refer to Vessel traffic below).

Underwater noise generated by construction vessels would not exceed injury thresholds for turtles, as noise levels produced by vessels in general are below levels that could cause potential auditory threshold shifts. Behavioral responses to vessels have been reported but are thought to be more associated with visual cues, as opposed to auditory cues (Hazel et al. 2007), although both senses likely play a role in avoidance. A conservative assumption is that construction and support vessels could elicit behavioral changes in individual sea turtles near the vessels. It is assumed that these behavioral changes would be limited to evasive maneuvers such as diving, changes in swimming direction, or changes in swimming speed to distance themselves from vessels. Overall, impacts to sea turtles from vessel noise would be **negligible** adverse.

Fixed-wing aircraft could be used during construction for marine mammal monitoring, and helicopters could be used for crew transport to and from construction vessels. Monitoring aircraft would operate at an altitude of 1,000 feet. Noise levels generated by helicopters and propeller-driven aircraft at this altitude range from 65 to 85 dBA (Behr and Reindel 2008; Brown and Sutherland 1980). Noise from crew transport helicopters would increase during approach and departure from vessel landing pads. Currently, no published studies describe the impacts of aircraft overflights on sea turtles, although anecdotal reports indicate that sea turtles respond to aircraft by diving (BOEM 2017). While helicopter traffic could cause some temporary non-biologically significant behavioral reactions, including startle responses (diving or swimming away), altered submergence patterns, and a temporary stress response (BOEM 2017; NSF and USGS 2011; Samuel et al. 2005), these brief responses would be expected to dissipate once the aircraft has left the area. The potential effects of aircraft noise and disturbance on sea turtles are therefore expected to be **negligible** adverse.

Overall, based on the limited likelihood of exposure and implementation of effective EPMs and minimization measures, the noise effects on sea turtles during construction would be **negligible** to **minor** adverse.

<u>Presence of structures:</u> Effects on sea turtles from the construction and installation of WTG and OSS foundations would result primarily from underwater noise impacts related to impact pile driving and noise and disturbance from associated vessel activity. These impacts are described under the applicable IPFs for each type of disturbance. Indirect effects on sea turtles, such as reduced availability of forage or prey, could also result from impacts on benthic habitat and invertebrate prey species. These effects, including the anticipated acreages of benthic habitat affected by the presence of structures, are described in Sections 3.6.2.2.1 and 3.6.2.3.1. While indirect effects to invertebrate prey resources would occur, these impacts are not likely to significantly affect the availability of prey and forage resources for sea turtles because of their broad resource base and the minimal anticipated adverse effect to invertebrates during the construction phase. Therefore, construction and installation of offshore structures would have temporary, **negligible** to **minor** adverse effects on sea turtles, varying in significance by species.

<u>Vessel traffic:</u> Changes in vessel traffic resulting from the Proposed Action are a potential source of adverse effects on sea turtles. Propeller and collision injuries from boats and ships are common in sea turtles and an identified source of mortality (Hazel et al. 2007; Shimada et al. 2017). Hazel et al. (2007) also reported that individuals may become habituated to repeated exposures over time, when not accompanied by an overt threat. Project construction vessels could collide with sea turtles, posing a temporary increase in the risk of injury or death to individual sea turtles. However, implementation of a range of EPMs to avoid vessel collisions (see Appendix F, Table F-1) are expected to minimize the risk of

collisions with sea turtles. These include strict adherence to NOAA guidance for collision avoidance and a combination of additional measures, including speed restrictions to 10 knots or less for all vessels at all times between November 1 and April 30 and speed restrictions to 10 knots or less in DMAs. All vessel crews would receive training to ensure these EPMs are fully implemented for vessels in transit. Once on station, the construction vessels either remain stationary when installing the monopiles and WTG/OSS equipment or move slowly (i.e., at less than 10 knots) when traveling between foundation locations. Cable laying and HRG survey vessels also move slowly, with typical operational speeds of less than 1 and approximately 4 knots, respectively.

Based on information provided by Revolution Wind (Tech Environmental 2021), BOEM estimates that Project construction would require up to 968 one-way trips by various classes of vessels between the RWF and regional ports in Rhode Island, Massachusetts, Connecticut, New Jersey, Virginia, and Maryland, as well as ports in Europe, over the 2-year construction period. This equates to approximately 40 trips per month, or 484 trips per year. In addition, approximately 10,755 linear miles of preconstruction HRG surveys are anticipated to support micrositing of the WTG foundations and cable routes. HRG surveys could occur during any month of the year and would require a maximum of 248 total vessel days. The construction vessels used for Project construction are described in Table 3.3.10-3 in the COP and include jack-up WTG installation vessels, foundation installation vessels, supply vessels and feeder barges, bunkering vessels, cable laying vessels, and various support craft. Typical large construction vessels used in this type of project range from 325 to 350 feet in length, from 60 to 100 feet in beam, and draft from 16 to 20 feet (Denes et al. 2021).

Large construction vessels and barges would account for an estimated 44% of these one-way trips, with the remainder comprising CTVs and other small support vessels. BOEM developed a representative analysis of construction vessel effects on regional traffic volume by evaluating the potential increase in transits across a set of analysis cross sections relative to baseline levels of vessel traffic. These cross sections were developed by DNV GL Energy USA, Inc. (2020) to support the COP and are shown in Figure 3.15-2.

Using the port of origin information provided by Revolution Wind (Tech Environmental 2021), the estimated 484 construction vessel trips per year would cross transects 13-17 when leaving the RWF and could cross several different transects depending on the destination port. This would equate to a 23% increase in vessel transits across these transects. However, the Automatic Identification System (AIS) data used in transect analysis do not include many recreational vessels and virtually all commercial fishing vessels when actively fishing. These vessel types account for the vast majority of vessel activity. For example, DNV GL Energy USA, Inc. (2020) estimated over 19,000 one-way trips per year by commercial fishing vessels between the RWF and area ports. When these vessel trips are included, Project construction would result in a 2.1% increase in vessel transits per year across transects 13-17. In summary, this assessment indicates that construction vessels would likely increase vessel traffic to some degree, and large vessel traffic would measurably increase during the 2-year construction period. This indicates the potential for increased risk of sea turtle collisions in the absence of planned EPMs and other requirements.

Sea turtles are likely to be most susceptible to vessel collision in coastal foraging areas crossed by construction vessels traveling between the RWF and offshore RWEC and area ports. Hazel et al. (2007) indicated that sea turtles may not be able to avoid being struck by vessels at speeds exceeding 2 knots, and collision risk increases with increasing vessel speed. Habituation to noise may also increase the risk of vessel collision. However, avoidance behaviors observed suggest that a turtle's ability to detect an approaching vessel is more dependent on vision than sound, although both may play a role in eliciting behavioral responses. Construction vessel speeds could periodically exceed 10 knots during transits to and from area ports, posing an increase in collision risk relative to baseline levels of vessel traffic. During construction, vessels generally either remain stationary when installing the monopiles and WTG/OSS equipment or move slowly (i.e., at less than 10 knots) when traveling between foundation locations. Cable-laying vessels move slowly, on the order of 3 to 30 miles per day, with a maximum speed of approximately 1.2 miles per hour. Project EPMs include the implementation of NOAA vessel guidelines (see Appendix F) for marine mammal and sea turtle strike avoidance measures, including vessel speed restrictions. Nevertheless, collisions with individual turtles could occur, resulting in mortalities. Because the abundance of sea turtles is anticipated to be generally low with patchy distribution, and the proportional increase in vessel traffic is also low, the number of sea turtles injured or killed by vessel strikes during Project construction would be low and would have negligible effects at the population level. Therefore, the potential effects of construction vessel collisions on sea turtles would be **minor** adverse.

Onshore Activities and Facilities

Construction of onshore Project facilities and associated activities would not result in measurable impacts on the marine environment. Therefore, onshore activities and facilities would have no measurable effect on sea turtles and would therefore be **negligible** adverse.

3.19.2.2.2 Operations and Maintenance and Decommissioning

Offshore Activities and Facilities

Accidental releases and discharges: The RWF would undergo maintenance as needed, which would necessitate vessels and other equipment at the facility for the life of the Project. This presents an opportunity for accidental discharge or spills of fuels and/or fluids during maintenance activities. Spill response EPMs (see Table F-1 in Appendix F) employed during construction would be implemented during maintenance activities. These EPMs are expected to avoid or minimize water quality impacts from accidental spills or releases of pollutants during O&M activities. Impacts on sea turtles from accidental spills or releases of pollutants are considered **minor** adverse because of the low probability of the risk and EPMs (refer to Section 3.21 for additional details).

Noise: WTG operations, O&M and monitoring vessels, and postconstruction HRG surveys would generate underwater noise detectable by sea turtles. Tougaard et al. (2020) summarized available monitoring data on wind farm operational noise, including both older generation geared turbine designs and quieter modern direct-drive systems like those proposed for the RWF. They determined that operating turbines produce underwater noise on the order of 110 to 125 dB_{RMS}, occasionally reaching as high as 128 dB_{RMS}, in the 10-Hz to 8-kHz range. This is consistent with the noise levels observed at the BIWF (110 to 125 dB re 1 µPa SPL rms) (Elliot et al. 2019) and the range of values observed at European wind farms and is therefore representative of the range of operational noise levels likely to occur from future wind energy projects. More recently, Stober and Thomsen (2021) used monitoring data and modeling to estimate operational noise from larger (10 MW) current generation direct-drive WTGs and concluded that these designs could generate higher operational noise levels than those reported in earlier research. This suggests that operational noise effects on sea turtles could be greater than those considered herein, but these findings have not been validated. The Project would generate operational noise throughout the life of the RWF. As noted previously, sea turtle hearing is largely within the frequency range (< 1,200 Hz) for operational wind turbines; therefore, it is possible that wind turbine noise could be heard by sea turtles, although behavioral responses are unlikely based on the established threshold.

Little is known currently about how sea turtles use hearing in their natural environment (Lavender et al. 2014); therefore, it is difficult to interpret the potential effects of long-term, non-impulsive noise generated by the WTGs. O'Hara and Wilcox (1990) reported that loggerheads avoid sources of low-frequency sound in the 25- to 1,000-Hz range. The sound levels produced during operation are less than the behavioral and injurious thresholds defined by NMFS for sea turtles. However, potential responses to underwater noise generated by WTG operation could include avoidance of the noise source. Operational noise levels would not cause injury to sea turtles but could alter the behavior of individuals close to the structure. Localized behavioral long-term effects from operational noise would be **negligible** adverse because of the limited likelihood of behavioral effects.

While sea turtles would likely be able to detect O&M vessels in the vicinity, this would not necessarily translate to biologically significant effects. For example, Hazel et al. (2007) concluded that sea turtles appear to be relatively insensitive to vessel noise, relying on their vision to detect approaching vessels. Sea turtles may respond to vessel approach and/or noise with a startle response (diving or swimming away) and a temporary stress response (NFS and USGS 2011). In contrast, Samuel et al. (2005) indicated that vessel noise can affect sea turtle behavior, especially their submergence patterns. BOEM anticipates that the potential effects of noise from O&M vessels would elicit brief responses to the passing vessel that would dissipate once the vessel or the turtle left the area. For these reasons, BOEM anticipates that sea turtle exposure to vessel noise would be minimal, and responses if any, would be temporary and biologically insignificant, with individuals returning to normal behaviors once the vessel has passed.

Up to 1,062 linear miles of postconstruction HRG surveys could be conducted each year for the first 4 years of Project operations to ensure transmission cables are maintaining desired burial depths. This equates to approximately 25 days of HRG survey activity per year. The related effects on sea turtles would be similar in nature to those described for construction-related HRG surveys in Section 3.19.2.2.1 but reduced in extent and duration. The limited behavioral responses to HRG survey equipment and vessels would be similar to those described above for general O&M vessel noise.

Project decommissioning would require the use of construction vessels of similar number and class as those used during construction. Underwater noise and disturbance levels generated during decommissioning would be similar to those described above for construction, with the exception that pile driving would not be required. The monopiles would be cut below the bed surface for removal using a cable saw or abrasive waterjet. Noise levels produced by this type of cutting equipment are generally indistinguishable from engine noise generated by the associated construction vessel (Pangerc et al. 2016). Therefore, this decommissioning equipment would not contribute to additional noise effects above and beyond those already considered for construction vessel noise. The short-term effects of Project decommissioning on sea turtles would therefore range from **negligible** to **minor** adverse.

<u>Presence of structures:</u> The WTG and OSS foundations, exposed portions of the offshore RWEC, and associated scour protection would result in a long-term conversion of existing complex and non-complex

bottom habitat to new stable, hard surfaces. Once construction is complete, these surfaces would be available for colonization by sessile organisms and would draw species that are typically attracted to hard-bottom habitat (Causon and Gill 2018; Langhamer 2012). Refer to Section 3.6.2.2.2, 3.6.2.3.2, and 3.13.2.2 for a detailed overview of potential changes in food web dynamics caused by reef effects. Over time, this reef effect would increase the amount of forage and shelter available for sea turtles.

The WTG and OSS foundations constitute potential obstacles in the water column for the life of the Project until decommissioning. Given that sea turtles are highly mobile and the structures are only 36 to 45 feet in diameter and would be separated by approximately 1 mile, the structural alterations of the water column are unlikely to pose a direct barrier to foraging, migration, or other behaviors of sea turtles. However, the presence of WTG structures could indirectly affect sea turtles by potentially altering prey distribution or promoting fish aggregations and thus concentrating fishing vessels at the foundations. This range of potential impacts is discussed in the following paragraphs.

Human-made structures, especially tall, vertical structures like WTG and OSS foundations, may also alter local water flow at a fine scale and could result in localized impacts on sea turtle prey distribution and abundance. These localized effects typically dissipate within a relatively short distance from the structure (Miles et al. 2017); effects would likely dissipate within 300 to 400 feet of each monopile foundation. However, there is potential for regional impacts to wind wave energy, mixing regimes, and upwelling (van Berkel et al. 2020), and these changes in water flow caused by the presence of the WTG structures could influence sea turtle prey distribution at a broader spatial scale. The distribution of fish, invertebrates, and other marine organisms on the OCS is determined by the seasonal mixing of warm surface and cold bottom waters, which determines the primary productivity of the system (Chen et al. 2018; Lentz 2017; Matte and Waldhauer 1984). While there is a high degree of uncertainty, the presence of WTG structures could affect conditions in ways that alter these dynamics, potentially increasing primary productivity in the vicinity of the structures by disrupting vertical stratification and bringing nutrient-rich waters to the surface (Carpenter et al. 2016; Schultze et al. 2020). However, this increase in primary productivity may not translate to a beneficial increase in sea turtle prey abundance if the increased productivity is consumed by filter feeders, such as mussels, that colonize the surface of the structures (Slavik et al. 2019). Considering the largely localized nature of potential effects to primary production surrounding WTGs (van Berkel et al. 2020), the likelihood of broader benefits for sea turtles is minimal.

The overall effects of offshore structure development on ocean productivity, sea turtle prey species, and, therefore, sea turtles, are difficult to predict with certainty and are expected to vary by location, season, and year, depending on broader ecosystem dynamics. The addition of up to 102 new offshore foundations could increase sea turtle prey availability by creating new hard-bottom habitat, increasing pelagic productivity in local areas, or promoting fish aggregations at foundations (Bailey et al. 2014). These aterations may increase foraging opportunities for loggerhead and Kemp’s ridley sea turtles with preferences for more bottom-dwelling invertebrate prey. Increased primary and secondary productivity in proximity to structures could also increase the abundance of jellyfish, a prey species for leatherback sea turtles (English et al. 2017; NMFS and USFWS 1992). The artificial reefs created by these structures form biological hotspots that could support species range shifts and expansions and changes in biological community structure (Degraer et al. 2020; Methratta and Dardick 2019; Raoux et al. 2017). In contrast, broadscale hydrodynamic impacts could lead to localized changes in zooplankton distribution and abundance (van Berkel et al. 2020). As discussed in Section 3.6.2.3.2, hydrodynamic modeling conducted by Johnson et al. (2021) indicated project-related shifts in larval transport and settlement density, but these shifts are not expected to have broad-scale impacts on invertebrate populations. There is considerable uncertainty as to how these localized ecological changes would affect sea turtles and how those changes would interact with other human-caused impacts. The effect of these IPFs on sea turtles and their habitats could be positive or negative, varying by species, and their extent and magnitude is unknown. Recent studies have also found increased biomass for benthic fish and invertebrates, and possibly for pelagic fish, sea turtles, and birds, around offshore wind facilities (Pezy et al. 2018; Raoux et al. 2017; Wang et al. 2019), translating to potential increased foraging opportunities for sea turtle species. However, an increase in biomass could result in limited benefits to higher trophic levels, depending on species composition and prey preferences (Pezy et al. 2018).

Increased fish biomass around the structures could also attract commercial and recreational fishing activity, creating an elevated risk of injury or death from gear entanglement and ingestion of debris (Barreiros and Raykov 2014; Gregory 2009; Vegter et al. 2014). As noted above, lost/discarded fishing gear was associated with a majority of sea turtle entanglements in a global review (Duncan et al. 2017). However, through implementation of EPMs related to management of debris surrounding the WTGs (see Table FF-1 in Appendix FF), the increase in entanglement risk is expected to be minimal.

The presence of structures could result in multiple types of impacts, with potentially opposing outcomes for sea turtles. The presence of structures could indirectly concentrate recreational fishing around foundations, which could indirectly increase the potential for sea turtle ingestion of or entanglement in lines, nets, and other lost or discarded fishing gear (Gall and Thompson 2015; Nelms et al. 2016; Shigenaka et al. 2010). However, the addition of structures could benefit sea turtles by locally increasing pelagic productivity and prey availability for sea turtles. The overall impact to sea turtles is not expected to be biologically significant due to the patchy distribution of sea turtles in the northern portion of the GAA where the RWF and RWEC are located. Potential long-term, intermittent impacts could persist until decommissioning is complete and structures are removed. These impacts would be **negligible** to **minor** adverse, offset by **minor** beneficial impacts to sea turtle species that benefit from reef effects.

Decommissioning would remove the structures from the water column and effectively eliminate any operational effects of the presence of structures. No specific methods for decommissioning and removal of structures have been proposed, as the planned removal would occur at the end of the Project lifetime. The COP provides no indication that decommissioning would involve lines, rigging, or other equipment that could pose a potential entanglement risk to sea turtles. The Project would develop a decommissioning plan that specifies the methods and equipment proposed for structure removal. That plan would be subject to independent environmental compliance and regulatory review.

Vessel traffic: Revolution Wind (Tech Environmental 2021) has estimated that Project O&M would involve up to four CTV and two SOV trips per month for wind farm O&M, or 2,280 vessel trips over the life of the Project. These trips would originate either from an O&M facility located either in Montauk, New York, or Davisville, Rhode Island. One or more CTVs ranging from 62 to 95 feet in length would be purpose built to service the RWF over the life of the Project. SOVs are larger mobile work platforms, on the order of 215 to 305 feet long and 60 feet in beam, equipped with dynamic positioning systems used for more extensive, multiday maintenance activities (Ulstein 2021). Larger vessels similar to those used for construction could be required for unplanned maintenance, such as repairing scour protection or replacing damaged WTGs. Those activities would occur on an as-needed basis. Additional vessel trips would be required over the life of the Project forseafloor surveys and subsurface inspections. A minimum of three postconstruction seafloor bathymetry surveys would be conducted to assess foundation scour and correct if needed. Project fishery monitoring and benthic habitat monitoring surveys would also be conducted annually, as discussed above. Vessels used would be similar to those used for preconstruction HRG surveys.

In general, O&M-related vessel activities would represent a small increase in regional vessel traffic compared to existing conditions. Project O&M could involve up to 10 one-way vessel trips between the RWF and O&M facility or other area ports each month. By comparison, hundreds of large vessels and thousands of smaller vessels, many of the latter comparable in size to a CTV, travel through the areas between the wind farm and proposed O&M facility locations each month (Section 3.15.2.2.1). O&M vessel use would therefore represent a minimal increase in regional vessel traffic over the life of a facility and the effects to sea turtles are expected to be negligible adverse.

As detailed in Appendix F, all survey vessels would comply with speed restrictions and other minimization measures to minimize risk of collision with sea turtles, making the risk of vessel strikes from Project monitoring vessels unlikely. As described in the previous section, the applicant has voluntarily committed to specific EPMs, including vessel timing and speed restrictions, to avoid and minimize vessel-related risks to sea turtles (see Appendix F, Table F-1). Based on the generally low density of sea turtles in the Lease Area and the anticipated vessel trips during operations, there is a low risk of encountering a sea turtle. The operational conditions combined with planned EPMs (see Appendix F for all vessel strike avoidance measures) would minimize collision risk during construction and installation. During periods of low visibility, trained crew would use increased vigilance to avoid sea turtles. Because vessel strikes are not an anticipated outcome given the relatively low number of vessel trips and implementation of effective monitoring and EPMs. BOEM concludes vessel strikes have a low probability of occurrence and therefore would have a minor anticipated effect on sea turtles. In the unlikely event of a sea turtle strike by any vessel supporting the Project, Revolution Wind must immediately cease the activities until BOEM is able to review the circumstances of the incident and determine what, if any, additional measures are appropriate to ensure compliance with all applicable laws (e.g., ESA) and COP approval conditions.

As with construction, a similar increase in vessel round trips during decommissioning is expected to increase the relative risk of vessel strike for sea turtles. The implementation of NOAA guidelines (see Appendix F) as an EPM is intended to minimize the potential of vessel strikes for sea turtles by reducing vessel speed and maintaining a separation distance from sighted turtles. Collisions, if they do occur, are expected to be fatal to individuals. Because the abundance of sea turtles in the RWF and RWEC is anticipated to be generally low with patchy distribution, and the proportional increase in vessel traffic is also low, the number of sea turtles injured or killed by vessel strikes as a result of Project decommissioning would be low and would have negligible effects at the population level. Therefore, potential effects of vessel strikes on sea turtles from vessels supporting Project decommissioning would be minor adverse. Overall, the anticipated effect to sea turtles from vessel traffic associated with O&M and decommissioning would be **negligible** to **minor** adverse.

Onshore Activities and Facilities

Onshore Project activities would not result in impacts to marine resources. Therefore, impacts to sea turtles from O&M and decommissioning of the Proposed Action would be the same as under the No Action Alternative: **negligible** adverse.

3.19.2.2.3 Cumulative Impacts

Offshore Activities and Facilities

Accidental releases and discharges: Toxic contaminants and marine debris are recognized as significant sources of sea turtle injury and mortality and are leading threats to successful species conservation and recovery. The Proposed Action would increase commercial vessel activity on the OCS, creating a potential source for accidental spills, trash, and debris. BOEM estimates that the Project would result in a negligible, up to 5% increase in total chemical usage in the GAA relative to the No Action Alternative. When combined with other offshore wind projects, up to approximately 19 million gallons of coolants, oils, fuels, and lubricants could cumulatively be stored within WTG foundations and the OSS within the GAA. Compliance with USCG regulations and BOEM requirements to minimize the risk of accidental spills and/or release of trash and debris would limit the volume and extent of Project-related trash/debris or invasive species potentially released accidentally. Additionally, as discussed in Section 3.19.1.1, the volumes of trash/debris potentially released accidentally under the No Action Alternative would be negligible and would not contribute to potential adverse impacts. Therefore, cumulative impacts associated with the Project when combined with past, present, and reasonably foreseeable future activities would be **negligible** to **minor** adverse because of the regulatory protections and limited likelihood of sea turtle exposure.

Climate change: The types of impacts from global climate change described for the No Action Alternative would occur under the Proposed Action, but the Proposed Action could also contribute to a long-term net decrease in GHG emissions. As described in Section 3.19.1.1, the interactions between climate change and other potential impacts associated with the Proposed Action are complex and difficult to predict with certainty. Northward shifts in sea turtle distributions due to warming waters could result in magnification of the anticipated impacts due to increased exposure. However, this magnification includes potential benefits associated with the creation of artificial reef habitat and could represent an increasing impact over the life of the Project. Based on the potential for increased exposure to the various effects of the Proposed Action described above, the Proposed Action when combined with other past, present, and reasonably foreseeable actions is expected to result in **minor** adverse cumulative impacts to sea turtles due to the anticipated shifts in distributions.

Noise: The Proposed Action would result in localized, temporary, negligible to minor impacts to sea turtles through the generation of impulsive and non-impulsive underwater noise associated with offshore wind construction activities. BOEM estimates a cumulative total of 3,110 offshore WTGs and OSS foundations could be developed in the GAA for sea turtles between 2022 and 2030. Sea turtles are anticipated to occur at generally low densities (see Section 3.19.1) near wind farms in the region, reducing the probability of individual exposure to noise effects. Noise sources associated with the Proposed Action could add to the ambient noise environment under the No Action Alternative if noise sources overlap temporally or geographically. Pile driving would represent the most significant source of noise. As noted in Section 3.19.1.1, there are three possible exposure scenarios for pile-driving noise:

1) concurrent exposure from two or more impact hammers for the same or adjacent projects; 2) non-concurrent exposure from multiple pile-driving events in the same years; 3) exposure to concurrent and non-concurrent pile-driving events over multiple years. Although the extent, duration, and magnitude of exposure would vary based on Project -specific factors, the effects would be similar in nature to those described for the Proposed Action. Although exposure to pile-driving noise could disrupt behaviors of individual sea turtles, it is not expected to impair essential behavioral patterns. This is due to the temporary, localized nature of the effects and because normal behaviors are expected to resume once the sea turtle is no longer exposed to the noise. Permanent hearing impairment could occur to some individuals, but science has not determined whether if changes in hearing ability would negatively impact the ability of sea turtles to feed, navigate, find suitable habitats, and reproduce. Due to the limited information about noise-related stress responses in sea turtles, physiological stress responses may likely occur concurrently with any other response, such as hearing impairment or behavioral disruptions.

For impulsive noise, BOEM anticipates that projects would employ soft starts during pile driving to allow the small number of turtles in the region to leave the area before underwater noise increases to injurious levels. Additionally, the implementation of sound attenuation systems, PSO monitoring and clearance zones, and other planned EPMs (see Appendix F) would further reduce the likelihood of injury from the potential moderate cumulative impacts associated with pile driving. Vibratory pile driving associated with the sea-to-shore transition would create non-impulsive underwater noise, but similar to the effects of the impulsive impact hammer, only minor impacts to sea turtles are expected because of the combination of minimization measures used and the low densities of sea turtles in the RWF and RWEC. Potential behavioral effects are more likely to be related to vessel noise and disturbance than the vibratory pile driving itself.

With regard to other non-impulsive noise sources, potential behavioral impacts on sea turtles from vessel traffic noise would be intermittent and temporary as animals and vessels pass near each other. During construction and operation, helicopter traffic could cause some temporary behavioral reactions in sea turtles, but energy expenditures would be minimal.

Based on the above findings, noise-related impacts of the Proposed Action when combined with past, present, and reasonably foreseeable projects would result in **negligible** to **minor** adverse cumulative impacts to sea turtles, depending upon the noise source.

<u>Presence of structures</u>: The Proposed Action would result in long-term negligible and minor beneficial impacts to sea turtles through the installation of 102 structures (100 WTGs and two OSSs) to conditions under the No Action Alternative. The installation of monopile foundations would alter the character of the ocean environment, and their presence could affect sea turtle behavior. Increased prey availability, attraction to structures, and/or displacement could occur as a result of the installation of WTG facilities. As described in Section 3.19.2.2.2, structures associated with offshore wind farms are expected to provide some level of reef effect and could benefit sea turtle foraging by creating new hard-bottom habitat, increasing pelagic productivity in local areas, or promoting prey aggregations on foundations.

Some level of displacement of sea turtles out of the Lease Area and into areas with a higher potential for interactions with ships or recreational or commercial fishing gear could occur, particularly during construction phases, when elevated underwater noise levels occur. These intermittent impacts would persist until decommissioning is complete and structures are removed. Impacts could occur as a result of increased interaction with fishing gear, although annual monitoring, reporting, and cleanup of fishing gear around the base of the WTGs would reduce the extent of these impacts.

BOEM estimates a cumulative total of 3,110 offshore WTGs and OSS foundations for the Proposed Action plus all other future offshore wind projects in the GAA. For similar reasons as described above, the Proposed Action when combined with past, present, and reasonably foreseeable projects would result in **negligible** to **minor** adverse cumulative impacts and potential **minor** beneficial cumulative impacts to sea turtles.

Vessel traffic: The Proposed Action would result in minor impacts to sea turtles through the addition of construction and maintenance vessels within the GAA. This increased offshore wind-related vessel traffic during construction, and associated noise impacts, could result in localized, intermittent impacts on sea turtles, resulting in brief minor behavioral responses that would be expected to dissipate once the vessel or the individual has left the area. However, BOEM expects that these brief responses of individuals to passing vessels would be unexpected given the patchy distribution of sea turtles; no stock- or population-level effects would be expected. Additionally, the Proposed Action would implement EPMs (see Table F-1 in Appendix F) to minimize vessel strikes.

BOEM estimates a peak of 380 vessels supporting offshore wind development will be operating in the GAA over the next decade, of which up to 61 would be associated with the Proposed Action construction and six would be associated with O&M. This increase in vessel traffic poses an increased likelihood of collision-related injury and mortality relative to existing baseline conditions. Some sea turtlescould be injured or killed as a result, but the number of individuals impacted is not likely to significantly increase the existing mortality rate from vessel strikes. Additionally, BOEM expects that similar EPMs will be included in future offshore wind projects, helping to minimize the vessel strike risk. Therefore, cumulative impacts associated with the Project when combined with past, present, and reasonably foreseeable future activities would be **minor** adverse; however, BOEM does not expect the viability of sea turtle populations to be affected.

Onshore Activities and Facilities

Onshore Project activities would not result in impacts to marine resources. Therefore, cumulative impacts to sea turtles from onshore activities associated with all past, planned, and reasonably foreseeable future activities would be the same as under the No Action Alternative: **negligible** adverse.

3.19.2.2.4 Conclusions

Project construction and installation, O&M, and decommissioning would impact sea turtles through exposure to vessel traffic, underwater noise impacts, temporary habitat disturbance, and long-term habitat conversion. Individual sea turtles could be injured or killed by vessel collisions and underwater noise exposure during ProjectP construction, but the exposure risk is low and the number of individuals impacted would likely be small. Temporary habitat disturbance, including alteration of the seafloor and suspended sediment and burial effects, would be limited in extent and well below levels likely to have biologically significant effects on any sea turtle species. Reef effects created by the presence of offshore wind structures could beneficially increase foraging opportunities for species, such as loggerhead sea turtles, that forage on benthic crustaceans and other invertebrates.

On this basis, BOEM anticipates that the Proposed Action would result in **negligible** adverse to **minor** impacts to sea turtles, including **minor** beneficial impacts for species that are able to exploit the increased biological productivity created by reef effects on offshore wind structures. Overall, the impacts of the Proposed Action alone on sea turtles would likely be **minor** beneficial to **minor** adverse. Although some of the proposed activities and/or IPFs analyzed could overlap, BOEM does not anticipate that these combined effects would alter the overall significance determination because they would not alter impacts on any species to such a degree that measurable population-level effects would occur.

In the context of other reasonably foreseeable environmental trends and planned actions, the impacts under the Proposed Action resulting from individual IPFs would range from negligible to minor adverse and minor beneficial for some sea turtle species. The impact-level criteria are used to characterize effects of all IPFs. Applying these criteria, BOEM anticipates that the overall impacts associated with the Proposed Action when combined with past, present, and reasonably foreseeable activities would result in **minor** adverse impacts on sea turtles in the GAA because unavoidable adverse impacts on individual sea turtles could occur that coincide with other adverse effects resulting from climate change, but those impacts are unlikely to measurably affect the viability of any sea turtle species at the population level.

3.19.2.3 Alternatives C, D, E, and F

3.19.2.3.1 Construction and Installation

Offshore Activities and Facilities

Noise: Construction of Alternatives C through F would result in similar underwater noise impacts on sea turtles from foundation installation to those described for the Proposed Action in Section 3.19.2.2.1, but those impacts would be reduced in extent and duration because fewer structures would be installed. This would reduce the number of days of impact pile driving required to construct the Project and the associated extent and duration of underwater noise. Reducing the number of structures could also reduce the required extent of HRG surveys under each alternative relative to the Proposed Action, but BOEM has insufficient information to determine if this is the case. The potential distribution of UXOs within the RWF is not currently known, but the largest devices are most likely to be encountered within the central portion of the RWF and in state waters on the RWEC corridor at the mouth of and outside of Narragansett Bay (Ordtek 2021). The RWEC configuration would remain the same across all alternatives, and the probable area of occurrence within the RWF is sufficiently large that it is not possible to determine how changes in alternative configuration would affect the likelihood of UXO encounters. Therefore, impacts to sea turtles from HRG surveys and UXO detonation are considered to be the same across all alternatives.

Differences in the extent and duration for the Proposed Action and the different configurations proposed for Alternatives C through E are summarized in Tables 3.19-5, 3.19-6, and 3.19-7, respectively, based on the total number of WTG and OSS foundations requiring pile driving and underwater noise injury and behavioral effects thresholds. These tables display the number of structures installed and estimated days of pile-driving activity required to construct each alternative. As shown, while the extent and duration of potential noise exposure from impact pile-driving activities would vary between layouts, these effects would be similar in magnitude and general scale to the Proposed Action. Therefore, noise effects on sea turtles from the construction phase of each alternative would likewise vary by species and range from **negligible** to **minor** adverse. The potential use of larger capacity WTGs under Alternative F could result in more extensive operational noise impacts than the Proposed Action, but insufficient information is available to characterize differences in effect.

Table 3.19-5. Comparison of Maximum Underwater Noise Injury and Behavioral Effects Exposure Extent and Duration (number of sites/days) to Sea Turtles from Revolution Wind Farm Foundation Installation for the Proposed Action and Proposed Configurations for the Habitat Alternative*

Exposure Type	Threshold Distance (feet)†	Proposed Action	C1	C2
Peak injury	–	100 sites/ 35 days	64 sites/ 22 days	65 sites/ 22 days
Cumulative injury	98–689			
Behavioral or TTS	1,903–2,920			

* Installation scenario for 12-m monopile is 6,500 strikes/pile at installation rate of three piles/day. All piles installed with a 4,000-kJ hammer with an attenuation system achieving 10 dB sound source reduction.

† Threshold distances are the distance in feet from the sound source where the identified type of exposure could occur. WTG values are the range threshold distances for monopile installation modeled by Kusel et al. (2021) across modeled sites and seasonal conditions.

Table 3.19-6. Comparison of Maximum Underwater Noise Injury and Behavioral Effects Exposure Extent and Duration (number of sites/days) for Sea Turtles from Revolution Wind Farm Foundation Installation for the Proposed Action and Proposed Configurations for the Transit Alternative*

Exposure Type	Threshold Distance (feet)[†]	Proposed Action	D1	D1+D2	D1+D2+D3	D1+D3	D2	D2+D3	D3
Peak injury	–	100 sites/ 35 days	93 sites/ 31 days	92 sites/ 31 days	93 sites/ 31 days	85 sites/ 28 days	86 sites/ 29 days	85 sites/ 28 days	78 sites/ 26 days
Cumulative injury	98–689								
Behavioral	1,903–2,920								

* Installation scenario for 12-m monopile is 6,500 strikes/pile at installation rate of three piles/day. All piles installed with a 4,000-kJ hammer with an attenuation system achieving 10 dB sound source reduction.

[†] Threshold distances are the distance in feet from the sound source where the identified type of exposure could occur. WTG values are the range threshold distances for monopile installation modeled by Kusel et al. (2021) across modeled sites and seasonal conditions.

Table 3.19-7. Comparison of Maximum Underwater Noise Injury and Behavioral Effects Exposure Extent and Duration (number of sites/days) for Sea Turtles from Revolution Wind Farm Foundation Installation for the Proposed Action and Proposed Configurations for the Viewshed Alternative*

Exposure Type	Threshold Distance (feet)[†]	Proposed Action	E1	E2
Peak injury	–	100 sites/5 days	64 sites/21 days	81 sites/27 days
Cumulative injury	98–689			
Behavioral	1,903–2,920			

* Installation scenario for 12-m monopile is 6,500 strikes/pile at installation rate of three piles/day. All piles installed with a 4,000-kJ hammer with an attenuation system achieving 10 dB sound source reduction.

[†] Threshold distances are the distance in feet from the sound source where the identified type of exposure could occur. WTG values are the range threshold distances for monopile installation modeled by Kusel et al. (2021) across modeled sites and seasonal conditions.

Presence of structures: The presence of WTG and OSS monopile foundations associated with Alternatives C through F would result in similar impacts to sea turtles as those described for the Proposed Action in Section 3.19.2.2.2, but those impacts would be reduced in extent and would vary depending on the alternative selected. Refer to the tables in Section 3.6.2.4.2 for a summary of the number of structures proposed by alternative and configuration. Impacts of the presence of structures are expected to be relative to the total number of structures proposed (i.e., fewer structures would result in a smaller extent of impacts).

As with the Proposed Action, the overall impact to sea turtles from the presence of structures is not expected to be biologically significant due to the patchy distribution of sea turtles within the RWF and RWEC. Impacts from the presence of structures are expected to vary in relation to the total number of foundations proposed (i.e., fewer structures would result in less extensive impacts). For example, both configurations of Alternative C and Alternative E1 propose noticeably fewer WTG and OSS foundations compared to the Proposed Action and most configurations of Alternative D. Therefore, these alternatives would be expected to produce noticeably reduced impacts from this IPF by comparison. In general, presence of structures effects on sea turtles under Alternatives C through F would likely be less extensive compared to those resulting from the Proposed Action. Reef effects would be reduced commensurate with the number of foundations constructed under each alternative configuration.

At present, insufficient information is available to determine if differences in Project configuration between alternatives, specifically where foundations are located relative to sensitive benthic habitats, would contribute to a measurable difference in reef effects on sea turtles beyond those resulting from a simple reduction in the number of structures. As stated in Section 3.15.2.2.3, hydrodynamic effects are likely to lead to localized changes in the distribution of planktonic organisms (e.g., jellyfish) for certain sea turtle species, but shifts in prey distribution on the order of miles to tens of miles are unlikely to be biologically significant for species that migrate thousands of miles between seasonal habitats every year. Increased biological productivity resulting from reef effects could concentrate recreational fishing around foundations, which could theoretically increase the potential for harmful interactions with fishing gear. However, these reef effects would also benefit certain sea turtle species by increasing and concentrating prey availability. Therefore, while Alternatives C through F would likely alter and reduce the extent of measurable reef and hydrodynamic effects relative to the Proposed Action, those effects are likely to remain biologically insignificant. Potential long-term intermittent impacts would persist until decommissioning is complete and structures are removed. These impacts would also be **negligible** to **minor** adverse, offset by **minor** beneficial impacts to sea turtle species that benefit from reef effects.

3.19.2.3.2 Conclusions

The construction and installation, O&M, and decommissioning of Alternatives C through F would impact sea turtles through the same IPFs described for the Proposed Action. These impacts include exposure to increased vessel traffic, underwater noise impacts from Project construction and O&M, temporary habitat disturbance, and long-term habitat conversion. These adverse impacts would be avoided and minimized using the same EPM’s as described in the Proposed Action (see Table F-1 in Appendix F). Alternatives C through F would also generate similar beneficial reef effects but over a smaller area and with a reduced number of reef-forming structures. The resulting effects to sea turtles would therefore be similar to those described for the Proposed Action but reduced in extent and/or duration. However, the overall reduction in impacts would not be sufficient to alter the impact determinations for any sea turtle species. On this basis, BOEM concludes that Alternatives C through F would result in **minor** adverse effects to sea turtles, with those effects partially offset by **minor** beneficial impacts for some sea turtle species.

3.19.2.4 Mitigation

Additional mitigation measures identified by BOEM and cooperating agencies are described in detail in Appendix F, Table F-2 and below (Table 3.19-8).

Table 3.19-8. Proposed Mitigation Measures – Sea Turtles

Mitigation Measure	Description	Effect
Marine debris	Appropriate actions (e.g., training, marking, reporting) would be taken to minimize the potential for the introduction of trash and debris to the marine environment.	This measure would complement existing EPMs and regulatory requirements, ensuring that impacts from the accidental releases and discharges IPF would remain negligible adverse.
Sound field verification	Revolution Wind will develop a sound field verification plan and submit it to BOEM, the USACE, and NMFS for review and written approval at least 90 days prior to initiating underwater noise-producing construction activities. The sound field verification would provide the basis for established pre-start clearance and shutdown zones.	This measure would not modify the impact determination for noise effects on sea turtles but would provide the information necessary to ensure that these effects do not exceed the levels analyzed herein.
Passive acoustic monitoring	Revolution Wind will prepare a PAM plan to record ambient noise and vocalizations in the Lease Area. Acoustic monitoring will be implemented prior to and throughout the construction period and will continue for at least 2 years of Project operations after construction is complete. 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 construction and meet postconstruction monitoring needs. Underwater acoustic monitoring will use standardized measurement methods and data processing and visualization metrics developed for the Atlantic Deepwater Ecosystem Observatory Network for the U.S. Mid- and South Atlantic OCS (see https://adeon.unh.edu). At least two PAM buoys will be independently deployed within or bordering the RWF Lease Area, or one or more buoys will be deployed in coordination with other acoustic monitoring efforts in the RI and MA lease areas.	This measure would not modify the impact determination for construction and operational noise effects on sea turtles but would improve understanding of these impacts on specific resources and inform future management and mitigation measures.
PSO coverage	BOEM, BSEE, and the USACE would ensure that PSO coverage is sufficient to reliably detect sea turtles	This measure would not modify impact determinations on sea

Mitigation Measure	Description	Effect
	at the surface in clearance and shutdown zones to execute any pile-driving delays or shutdown requirements.	turtles but would provide the information necessary to ensure that these effects do not exceed the levels analyzed herein.
Pile-driving monitoring	Revolution Wind will prepare a pile driving monitoring plan in coordination with the PAM plan. PAM data would be used to determine potential marine mammal presence in the vicinity of project activities. RWF will provide sufficient protected species observer (PSO) coverage to reliably detect marine mammals within established clearance and shutdown zones. PSOs must have effective visual monitoring of all clearance zones in all directions prior to the commencement of pile driving.	This measure would not modify the impact determination for noise effects on sea turtles but would provide the information necessary to ensure that these effects do not exceed the levels analyzed herein.
Shutdown zone and clearance zone adjustment	BOEM, BSEE, and NMFS may consider reduction adjustments in the pre-start clearance and/or shutdown zones based on the initial sound field verification measurements. If initial measurements indicate distances to sea turtles are greater than predicted by modeling assuming 10 dB attenuation, Revolution Wind will implement additional sound attenuation measures prior to conducting additional pile driving.	This measure would not modify the impact determination for noise effects on sea turtles but would provide the information necessary to ensure that these effects do not exceed the levels analyzed herein.
Monitoring zones for sea turtles	BOEM, BSEE, and the 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.	This measure would not modify the impact determination for noise effects on sea turtles but would provide the information necessary to ensure that these effects do not exceed the levels analyzed herein.
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.	This measure comprises a set of requirements to review current sea turtle sighting information in the region, to maintain constant watch over a 500-meter vessel strike awareness zone during vessel transits, and to slow vessels to a speed of 4 knots or less when sea turtles are observed or likely to be present based on observed concentrations of prey. This measure would complement existing EPMs and ensure their effectiveness. While it would not modify the impact determination for vessel-related effects on sea

Mitigation Measure	Description	Effect
		turtles, it would help to ensure that these effects do not exceed the levels analyzed herein.
Vessel communication	Visual observations of marine mammals will be communicated to all Project vessels to coordinate implementation of related EPMs and mitigation measures.	This measure would complement existing EPMs and ensure their effectiveness. While it would not modify the impact determination for vessel-related effects on sea turtles, it would help to ensure that these effects do not exceed the levels analyzed herein.
Vessel speed restriction	All vessels, regardless of size, would comply with a 10-knot speed restriction in any SMA, DMA, or Slow Zone.	This measure would complement existing EPMs and ensure their effectiveness. While it would not modify the impact determination for vessel-related displacement effects on marine mammals, it would help to ensure that these effects do not exceed the levels analyzed herein.
Gear management	Sampling or survey gear would be regularly maintained and monitored to limit the potential for entanglement. Gear would be uniquely marked, and all reasonable efforts would be undertaken to recover lost gear.	This measure would complement existing EPMs and ensure that entanglement risk associated with survey activities and potential impacts on sea turtles remain negligible.
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 Sea Turtle Disentanglement Network Guidelines.	This measure would complement existing EPMs and ensure that entanglement risk associated with fixed gear and potential impacts on sea turtles remains negligible.
Sea turtle data	Any sea turtles caught and/or retrieved in survey gear would be identified to species or species group, properly documented, and data collected, then live, uninjured animals would be returned to the water as quickly as possible after completing the required handling and documentation.	This measure would not modify the impact determination for sea turtles but would provide the information necessary to ensure that these effects do not exceed the levels analyzed herein.
Sea turtle handling	Atlantic sturgeon caught and/or retrieved in survey gear 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.	This measure would not modify the impact determination for sea turtles but would provide the information necessary to ensure that these effects do not exceed the levels analyzed herein.

Mitigation Measure	Description	Effect
Take notification	GARFO PRD would be notified as soon as possible of all observed takes of Atlantic sturgeon occurring as a result of any fisheries survey.	This measure would not modify the impact determination for sea turtles but would provide the information necessary to ensure that these effects do not exceed the levels analyzed herein.
Reporting	BOEM and BSEE would ensure that Revolution Wind submits regular (e.g., monthly) reports to document the amount of extent of take that occurs during all phases of the Proposed Action.	This measure would not modify the impact determination for any IPF but would contribute to improved understanding of marine mammal use of the RWF and vicinity.
Data collection	BOEM and BSEE would ensure that all Project design criteria and BMPs incorporated in the Atlantic data collection consultation for offshore wind activities (Baker and Howson 2021) shall be applied to activities associated with the construction, maintenance and operations of the Revolution Wind Project as applicable.	This measure would not modify the impact determination for sea turtles but would provide the information necessary to ensure that these effects do not exceed the levels analyzed herein.

3.20 Visual Resources (see section in main EIS)

3.21 Water Quality

3.21.1 Description of the Affected Environment and Environmental Consequences of the No Action Alternative for Water Quality

3.21.1.1 Offshore Water Quality

Geographic analysis area: The GAA for offshore water quality impacts comprises coastal and marine waters within 10 miles of Project components and within 15.5 miles of waterways for ports that could be used during the Project (Figure 3.21-1). This analysis area was chosen by analyzing a worst-case scenario of an incidental oil discharge under the Project, which would equate to the simultaneous release of all oils used by all Project components and vessels.

Affected environment: Offshore waters in the offshore water quality analysis area comprise coastal waters (e.g., ports and harbors, bays, and estuaries; marine waters) located within the state territory (within 3 nm of shore) and within federal waters. The coastal waters, including the Long Island Sound, Block Island Sound, Rhode Island Sound, Narragansett Bay, and Atlantic Ocean, are located offshore and include existing port facilities in New York, Connecticut, Rhode Island, Virginia, Massachusetts, Maryland, and New Jersey that could be used for the Project. Because of their highly seasonal variations in temperature, stratification, and productivity, marine waters are considered temperate. Water currents near the shoreline of the landing site flow predominantly southwest and northeast, and water currents in the northern and southeastern portions of the offshore portion of the Lease Area flow predominantly south and east (RPS 2021). Along the proposed RWEC, currents were measured up to approximately 0.2 m/s, which increased to approximately 0.4 m/s at Narragansett Bay (RPS 2021).

Near the Lease Area, NOAA reported annual increases in relative sea level trends at seven tide stations (NOAA 2021a, 2021b, 2021c, 2021d, 2021e, 2021f, 2021g), including four along the Long Island coast (Bridgeport, Port Jefferson, New London, and Montauk), two along the Rhode Island coast (Newport and Providence), and one along the Massachusetts coast (Woods Hole) with increases ranging from approximately 2.4 millimeters per year at Providence, Rhode Island, to 3.41 millimeters per year at Montauk, New York. These increasing sea levels in addition to storm surges that are increasing in both frequency and magnitude have contributed to coastal erosion that has led to eroded shorelines and increased susceptibility to flooding (New York Sea Grant 2018; Rhode Island Coastal Resources Management Council 2014).

Offshore water quality is characterized by dissolved oxygen (DO), chlorophyll *a*, nutrients (phosphorus and nitrogen), pathogens, contaminants (metals, polychlorinated biphenyls [PCBs], and organic and inorganic pollutants), turbidity, and point and nonpoint source pollution. These parameters, which are described in COP Section 4.2.2 (vhb 2022), influence coastal and marine environments and are indicators of ecosystem health. In general, salinity levels in the region have low variability. Salinity ranged from 23.7 to 28.4 practical salinity unit (psu) in Narragansett Bay from 2005 through 2015, as well as 32 to 33 psu in the broader New England lease area between 1980 and 2007 (BOEM 2021a).

As described in COP Section 4.2.4 (vhb 2022), surface water temperatures fluctuate up to 59 degrees Fahrenheit (°F) seasonally, with bottom waters experiencing smaller seasonal temperature fluctuations of approximately 41°F. Water temperatures are highest in July and August when the water column becomes stratified; RWF surface water temperatures are close to 68°F, while bottom waters are approximately

50°F. During the winter, average surface water temperatures range from approximately 39°F to 41°F, with bottom waters staying slightly warmer at the southern edge of Rhode Island Sound.

The Project, including offshore facilities and ports, would be located within the northeast and mid-Atlantic regions of the United States, as defined by the EPA (2012). Overall water quality along the Atlantic coast has been rated "fair" to "good" (EPA 2012). The Mid-Atlantic region's water quality has been rated as generally "good," and the northeast region's water quality has been rated "fair" (EPA 2012). Water quality in the Long Island Sound from the Port Jefferson area eastward has generally improved or remained "very good" over the past decade (University of Maryland 2018). In general, water quality improves north to south from Narragansett Bay to the OCS (EPA 2012). Seventy percent of Rhode Island coastal waters are categorized as Type 1 (i.e., waters abut shorelines in natural undisturbed conditions) and Type 2 (i.e., waters are adjacent to predominantly residential areas; docks are allowed but other more intensive uses are not) (Rhode Island Division of Planning 2016). The water quality of estuarine waters off the coast of Rhode Island, including Narragansett Bay and nearby coastal ponds, has experienced degradation from nutrients and stormwater runoff carrying contaminants, although overall water quality in the area is generally good (Rhode Island Division of Planning 2016).

DO concentrations for offshore waters along the Atlantic coast and in the northeast region have been rated as generally "fair" (EPA 2012). DO concentrations have been rated as "good" within the Mid-Atlantic region (EPA 2012). Low DO concentrations have been measured at Long Island Sound monitoring stations (EPA 2012); however, water quality surveys at stations in the Rhode Island Sound revealed DO concentrations in surface and bottom waters above established levels for the "highest quality marine waters" (RI CRMC 2010). The upper reaches of Narragansett Bay and urbanized tidal rivers and embayments have been more heavily impacted by urbanized areas, which has led to continued water quality degradation, including low DO levels from excess nutrient (nitrogen) runoff (Rhode Island Division of Planning 2016). Chlorophyll *a* concentrations in samples from Rhode Island Sound and Block Island Sound were variable but representative of oceanic systems and comparable to each other and other coastal systems (RI CRMC 2010; RPS 2021). In Narragansett Bay, chlorophyll *a* concentrations were slightly higher compared to the overall northeast coast region (RI CRMC 2010; vhb 2022).

Pathogens and nutrients, which are transported from point and nonpoint sources of pollution to coastal waters through stormwater and wastewater discharges (RI CRMC 2016), are the most prevalent pollutants degrading water quality in Rhode Island (Rhode Island Division of Planning 2016). There have been no documented reports of harmful algal blooms or waterborne pathogen outbreaks in the Block Island Sound or Rhode Island Sound (EPA 2012; RI CRMC 2010); however, excess nutrients (nitrogen) in Narragansett Bay have led to oxygen depletion events (hypoxia and anoxia) that have degraded water quality conditions (EPA 2012; Rhode Island Division of Planning 2016). Dissolved nutrients from Narragansett Bay, in addition to those from Long Island Sound, reach OCS waters and contribute to degraded water quality conditions (vhb 2022). Nutrient levels in Rhode Island waters have decreased over the past 15 years (RI CRMC 2016; vhb 2022), and Rhode Island's southern shoreline waters have overall remained acceptable for both swimming and shellfishing (Rhode Island Division of Planning 2016). Dissolved inorganic phosphorus (a form of phosphorus in fertilizers) concentrations at monitoring stations in the Long Island Sound and Narragansett Bay were rated as "poor" (0.05–0.20 milligram per liter) (EPA 2012).

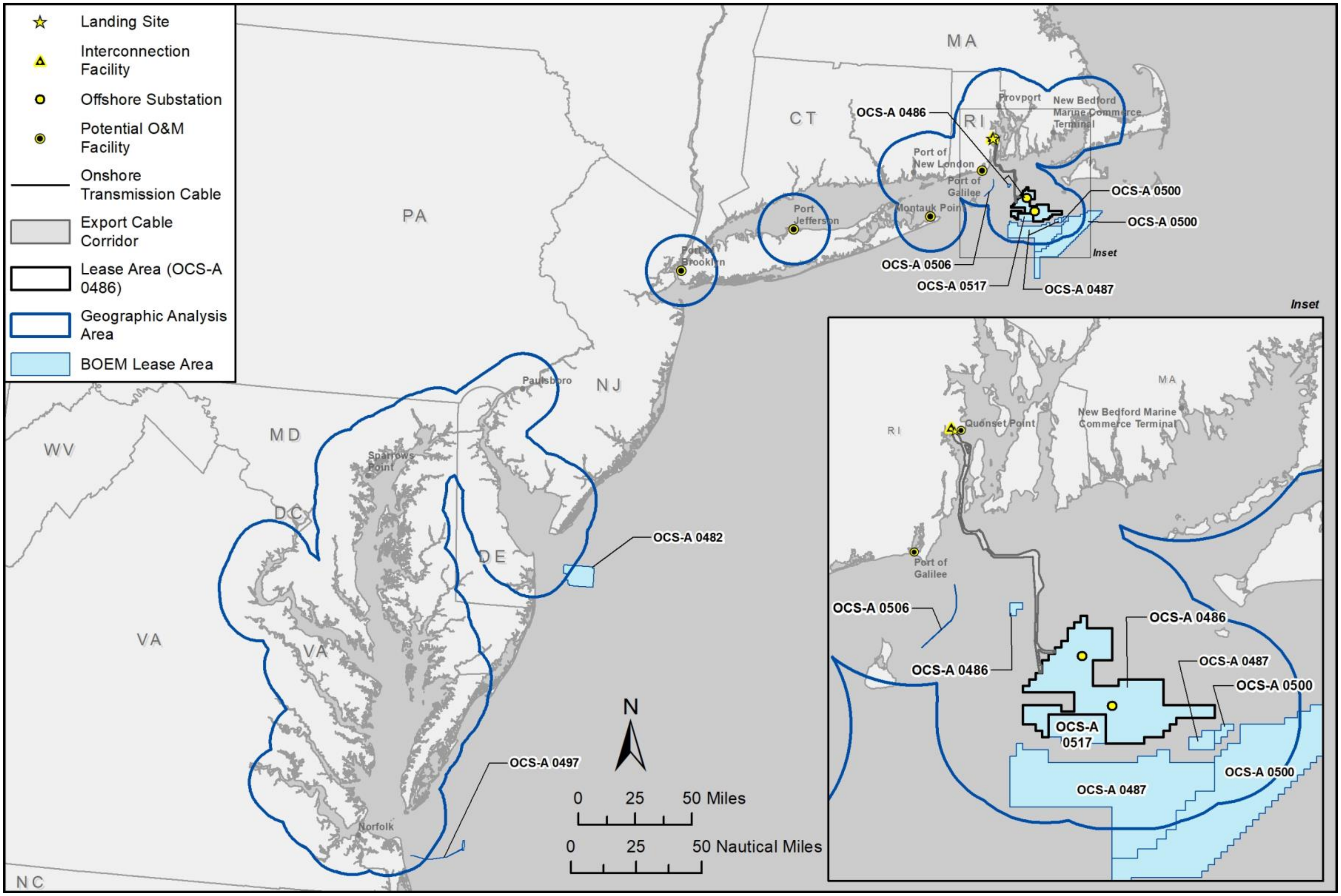

Figure 3.21-1. Geographic analysis area for offshore water quality.

Data are limited for water-column contaminant levels. In the Rhode Island Sound, organic contaminants were below detectable limits (USACE 2004; vhb 2022). Higher concentrations of heavy metals and PCBs have been identified in the northern reaches of Narragansett Bay compared to lower reaches (vhb 2022). Past investigations in and around the analysis area have not identified metal, PCB, or organic and inorganic pollutant concentrations above ambient water quality criteria (RI CRMC 2010). Contaminants could also reside within the sediment column and contribute to water quality conditions if disturbed. The Narragansett Bay is rated as "poor" for sediment toxicity (EPA 2012).

Turbidity is influenced by currents and storms, which lead to the resuspension of clay, silt, and fine-grained sand that comprise the sediment. Federal marine waters typically have very low concentrations of total suspended solids. Past investigations in the Rhode Island Sound revealed a range of turbidity levels from 0.1 to 7.4 milligram per liter of total suspended solids (USACE 2004; vhb 2022). Within the Narragansett Bay, annual average visibility depth in 2017–2019 ranged from 1.7 to 2.3 meters. See COP Section 4.2 (vhb 2022) for additional information regarding physical oceanographic and meteorological conditions within the analysis area.

3.21.1.1.1 Future Offshore Wind Activities (without Proposed Action)

This section discloses potential offshore water quality impacts associated with future offshore wind development. Analysis of impacts associated with ongoing activities and future non–offshore wind activities is provided in Appendix E1.

<u>Accidental releases and discharges:</u> Future offshore wind activities could contribute to changes in offshore water quality from a spill or release during routine vessel or equipment use, a spill at an offshore wind facility, a spill during construction and installation due to a vessel allision or collision, or the accidental discharge of trash and debris.

Numerous offshore wind projects could occur with overlapping construction schedules between 2022 and 2032 (see Appendix E). This EIS estimates that up to approximately 1.8 million gallons of coolants, fuels, oils, and lubricants could be stored within WTG foundations and the OSS within the offshore water quality GAA. Other chemicals, including grease, paints, and sulfur hexafluoride, would also be used at the offshore wind projects. BOEM anticipates that the likelihood of a major spill of these chemicals during construction due to vessel allisions, collisions, O&M activities, or weather events is very low (once per 1,000 years) (Bejarano et al. 2013). All future offshore wind projects would be required to comply with regulatory requirements related to the prevention and control of accidental spills administered by the USCG and BSEE. OSRPs are required for each project and would provide for rapid spill response, cleanup, and other measures that would help to minimize potential impacts on affected resources from spills. WTGs and OSSs are generally self-contained and would not generate discharge (see COP Appendix D). Vessels would also have onboard containment measures that would further reduce the impact of a spill in the event of an allision or collision.

A release during construction or operations of offshore wind projects would generally be classified as "routine" and minor adverse because of the size of the release (i.e., spills less than 10 barrels, or 420 gallons) and its rapid dispersion (BOEM 2015). Routine spills would result in little change to water quality and would therefore be localized, short term, and **minor** adverse. In the unlikely event an allision or collision involving Project vessels or components resulted in a large spill, impacts on water quality would be **minor** to **moderate** adverse, and would range from short term to long term, depending on the type and volume of material released, the specific conditions (e.g., depth, currents, weather conditions) at the location of the spill, and effectiveness of the cleanup techniques deployed.

Vessel operators would be required to comply with federal and international requirements for the management of shipboard trash and the USCG ballast water management requirements outlined in 33 CFR 151 and 46 CFR 162. Accidental releases of trash and debris would be infrequent and **negligible** adverse, and any allowed vessel discharges, such as bilge and ballast water, would be restricted to uncontaminated or appropriately treated liquids.

Anchoring and new cable emplacement/maintenance: Offshore wind activities would contribute to changes in offshore water quality from resuspension and deposition of sediments during anchoring. BOEM estimates that approximately 698 acres of seafloor could be impacted by anchoring under the No Action Alternative within the offshore water quality GAA. Disturbances to the seafloor during anchoring would temporarily increase suspended sediment and turbidity levels in and immediately adjacent to the anchorage area. Currents and storms currently contribute to turbidity throughout the water column from the resuspension of clay, silt, and fine-grained sand making up the sediment. As a result, adverse impacts on offshore water quality under the No Action Alternative would be **minor** adverse and temporary.

BOEM estimates that approximately 3,134 acres of seafloor could be impacted by cable placement under the No Action Alternative within the offshore water quality GAA due to reasonably foreseeable offshore wind development. Similar to anchoring, these activities would contribute to changes in offshore water quality from the resuspension and deposition of sediment. Sediment suspension and deposition from offshore wind projects would be limited in terms of extent and duration.

BOEM anticipates that future offshore wind projects would use dredging only when necessary and would rely on other cable laying methods for reduced impacts (such as jet plow or mechanical plow) where feasible. Furthermore, these impacts from individual projects would not be expected to overlap with one another spatially or temporally. For these reasons, sediment suspension associated with other wind projects would be localized, **minor** adverse, and temporary.

Port utilization: Offshore wind development would use nearby ports as described in Chapter 2 and could also require port expansion or modification, resulting in increased vessel traffic or increased suspension and turbidity from in-water work. These activities could also increase the risk of accidental spills or discharges. However, these actions would be localized, and port improvements would comply with all applicable permit requirements to minimize, reduce, or avoid impacts on water quality. As a result, adverse impacts on offshore water quality under the No Action Alternative would be short term to long term **minor** adverse.

Presence of structures: Reasonably foreseeable offshore wind projects are estimated to result in no more than 205 structures by 2030 within the offshore water quality GAA. These structures could disturb up to 201 acres of seafloor within the water quality GAA from foundation and scour protection installation and disrupt bottom current patterns, leading to increased movement, suspension, and deposition of sediments. Scouring, which could lead to impacts on water quality through the formation of sediment plumes (Harris et al. 2011), would generally occur in shallow areas with tidally dominated currents. Structures could reduce wind-forced mixing of surface waters, whereas water flowing around the foundations could increase vertical mixing (Carpenter et al. 2016; Cazenave et al. 2016). Results from a recent BOEM (2021b) hydrodynamic model of four different WTG build-out scenarios of the offshore RI/MA WEA found that offshore wind projects could alter local and regional physical oceanic processes (e.g., currents, temperature stratification) through their influence on currents from WTG foundations and by extracting energy from the wind. The results of the hydrodynamic model study show that the introduction of offshore wind structures into the offshore area modifies the oceanic responses of current magnitude, temperature, and wave heights by 1) reducing the current magnitude through added flow resistance, 2) influencing the temperature stratification by introducing additional mixing, and 3) reducing current magnitude and wave height by extracting of energy from the wind by the OSW turbines. Alterations in currents and mixing would affect water quality, including DO, but would vary seasonally and regionally. WTGs and OSSs associated with reasonably foreseeable offshore wind projects would be placed in average water depths of 100 to 200 feet where current speeds are relatively low, and offshore cables would be buried where possible. Cable armoring would be used where burial is not possible, such as in hard-bottomed areas. BOEM anticipates that developers would implement best management practices to minimize seafloor disturbance from foundations, scour, and cable installation. As a result, impacts on offshore water quality under the No Action Alternative would be localized, short term, and **minor** adverse.

The exposure of offshore wind structures, which are mainly made of steel, to the marine environment can result in corrosion to the structures without protective measures. Corrosion is a general problem for offshore infrastructures, and corrosion protection systems are necessary to maintain the structural integrity. Protective measures for corrosion (e.g., coatings, cathodic protection systems) are often in direct contact with seawater and have different potentials for emissions, e.g., galvanic anodes emitting metals, such as aluminum, zinc, and indium, and organic coatings releasing organic compounds due to weathering and/or leaching. The current understanding of chemical emissions for offshore wind structures is that emissions appear to be low, suggesting a low environmental impact, especially if compared to other offshore activities, but these emissions may become more relevant for the marine environment with increased numbers of offshore wind projects and a better understanding of the potential long-term effects of corrosion protection systems (Kirchgeorg et al. 2018).

3.21.1.1.2 Conclusions

Under the No Action Alternative, BOEM would not approve the COP; Project construction and installation, O&M, and decommissioning would not occur; and potential impacts to offshore water quality associated with the Project would not occur. However, ongoing and future activities would have continuing temporary to long-term impacts on water quality from offshore spills or discharge, resuspension and deposition of sediments, scouring, or changes to current patterns and mixing.

BOEM anticipates that the range of impacts for reasonably foreseeable offshore wind activities would be minor to moderate adverse due to short-term erosion and sedimentation, discharges, and dispersal of contaminants during routine spills. As described in Appendix E1, BOEM anticipates that the range of impacts for ongoing activities and reasonably foreseeable offshore activities other than offshore wind would be minor to moderate adverse due to temporary or short-term disturbance to sediments during construction activities.

BOEM anticipates that the impacts associated with future offshore wind activities in the GAA combined with ongoing activities, reasonably foreseeable environmental trends, and reasonably foreseeable activities other than offshore wind would result in **minor** adverse impacts because the effects would be small and the resource would recover completely.

3.21.1.2 Onshore Water Quality

Geographic analysis area: The GAA for onshore water quality impacts comprises the watersheds and groundwater basins that cross or fall within the Lease Area (Figure 3.21-2). This analysis area was chosen to capture the extent of the natural network of waterbodies that could be affected by construction and operations activities of the Project.

Affected environment: The onshore analysis area for surface water encompasses the Lower West Passage subwatershed (Hydrologic Unit Code 010900040908), where all Project components would be located (see Figure 3.21-2). The Lower West Passage subwatershed includes more than 500 surface water features (U.S. Geological Survey 2004). The Project's onshore facilities would not cross surface waterbodies. The nearest surface water features to the Lease Area that would contribute to flows to and from the Lease Area include 10 perennial streams/rivers, three artificial paths, 16 swamps/marshes, and 12 perennial lakes/ponds. These waterbodies, which are identified in Figure 3.21-2, would have the greatest influence on or from the Project and are therefore the focus of this analysis of onshore water quality impacts.

Surface water quality within the onshore water quality analysis area is generally good. None of the surface waterbodies near the Lease Area are currently listed as impaired (Rhode Island DEM 2021a). There is only one named waterbody—Mill Creek—near the Lease Area. Mill Creek, including its tributaries, is designated as Class B (Rhode Island DEM 2021b), which includes waters that are designated for fish and wildlife habitat and primary and secondary contact recreational activities (250 RICR 150.05 (Rhode Island Department of State 2018).

Groundwater resources are limited in the analysis area. The Project would be located (at its closest point) approximately 0.1 mile west of the Conanicut Island Aquifer, which is a sole source aquifer (URI Environmental Data Center and Rhode Island GIS 2016a). At its nearest points, the Project would be located approximately 1.2 miles east of the nearest groundwater recharge area and 2 miles east of the Pettaquamscutt groundwater reservoir, which is classified as a Class GAA groundwater (URI Environmental Data Center and Rhode Island GIS 2016b, 2016c). Class GAA groundwaters are known or presumed suitable for drinking water use without treatment and fall within a water supply priority for the area (Rhode Island DEM 2009).

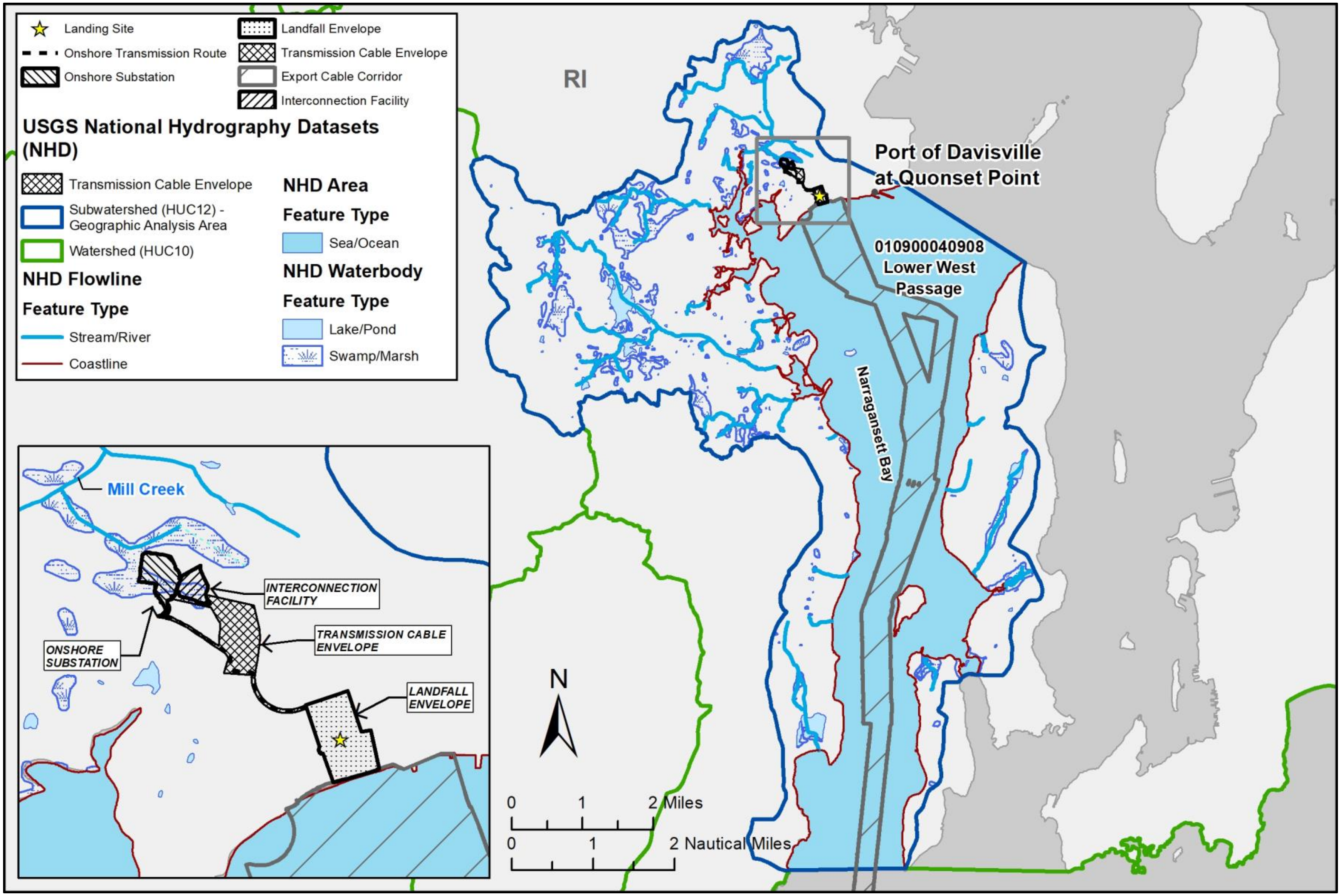

Figure 3.21-2. Geographic analysis area for onshore water quality.

There are 12 hazardous waste generating facilities near the Project (EPA 2021a). One of these facilities, the Senesco Marine Repair Yard, is approximately 0.7 mile from the eastern edge of the Project and 0.5 mile from the northeast corner of the cable corridor. The Senesco Marine Repair Yard has a current CWA violation within the past 12 months due to a violation of their NPDES permit (EPA 2021b). There is one hazardous waste cleanup site (EPA ID#: RID063900690) that includes the landfall work area (EPA 2021c). The waste storage container areas and tanks at this site have been "clean closed" in accordance with Resource Conservation and Recovery Act regulations, and there are no current identified violations at the facility (EPA 2021c, 2021d).

3.21.1.2.1 Future Offshore Wind Activities (without Proposed Action)

This section discloses potential onshore water quality impacts associated with onshore activities directly connected to or supporting future cumulative offshore wind development in the GAA. Analysis of impacts associated with ongoing and future non–offshore wind activities is provided in Appendix E1.

<u>Accidental releases and discharges:</u> Reasonably foreseeable onshore activities supporting OSW could contribute to changes in water quality from accidental releases and discharges, dispersal of contaminants during routine spills, or accidental releases of contaminated or hazardous materials or debris if surface water bodies are intersected. Routine spills that reach surface water would be expected to disperse rapidly (BOEM 2015).

Future onshore activities supporting OSW would be expected to comply with any applicable permit requirements, including spill controls, to minimize, reduce, or avoid impacts on surface water and groundwater quality. Degradations to onshore water quality from future onshore activities are expected to be localized and temporary to long term, depending on the nature of the activities, although overall water quality is expected to continue to meet Rhode Island water quality standards (250 RICR 150.05) (Rhode Island Department of State 2018). Surface and groundwater bodies would be monitored and managed to meet water quality standards and drinking water resource protections. As a result, adverse impacts from future onshore activities supporting OSW on onshore water quality under the No Action Alternative would be short term to long term **negligible** to **minor** adverse.

<u>New cable emplacement/maintenance:</u> Future onshore activities supporting OSW could result in changes to water quality from cable-related land disturbance, such as surficial digging, land clearing, trenching, HDD, and use of vehicles, that could contribute to erosion and sedimentation. These activities would be expected to comply with any applicable permit requirements to implement erosion and stormwater controls to minimize, reduce, or avoid impacts on water quality. Degradations to onshore water quality from future onshore activities are expected to be localized and temporary to long term, depending on the nature of the activities, although overall water quality is expected to continue to meet Rhode Island water quality standards (250 RICR 150.05). Waterbodies would be monitored and managed to meet water quality standards and drinking water resource protections. As a result, adverse impacts from future activities on onshore water quality under the No Action Alternative would be temporary to long term **negligible** to **minor** adverse.

<u>Port utilization:</u> Future onshore activities supporting OSW are expected to continue to use ports and would likely require expansion or modification of existing onshore port facilities in the analysis area. These port-related activities would include land disturbance.

Future expansion or modification of existing ports in addition to increased use could also increase the risk of accidental spills or discharges. However, these actions would be localized, and port improvements would comply with all applicable permit requirements to minimize, reduce, or avoid impacts on water quality. As a result, adverse impacts on onshore water quality under the No Action Alternative would be short to long term but **negligible** to **minor** adverse. Port activities would not include surficial digging that could encounter groundwater; as a result, there are no potential impacts on groundwater from port use (Rhode Island Department of State 2018).

Presence of structures: The presences of structures from future onshore activities supporting OSW would result in an increase in impervious surfaces that could contribute to stormwater runoff to nearby waterbodies. These activities would be expected to comply with any applicable permit requirements to implement erosion and stormwater controls to minimize, reduce, or avoid impacts on water quality. As a result, adverse impacts on onshore water quality under the No Action Alternative would be short term to long term **negligible** to **minor** adverse.

3.21.1.2.2 Conclusions

Under the No Action Alternative, BOEM would not approve the COP; Project construction and installation, O&M, and decommissioning would not occur; and potential impacts on onshore water quality associated with the Project would not occur. However, ongoing and future activities would continue to contribute temporary to long-term impacts on water quality from onshore erosion and sedimentation, or discharges, dispersal of contaminants during routine spills.

BOEM anticipates that the range of impacts for reasonably foreseeable offshore wind activities and connected onshore activities would be **negligible** to **minor** adverse due to short-term erosion and sedimentation, discharges, and dispersal of contaminants during accidental and routine spills. As described in Appendix E1, BOEM anticipates that the range of impacts for ongoing and reasonably foreseeable offshore activities other than offshore wind would be **negligible** to **minor** adverse primarily due to temporary or short-term disturbance to sediments during port expansion and other onshore construction and installation activities (e.g., beach and coastal restoration projects). Other reasonably foreseeable non–offshore wind IPFs with potential for routine and/or accidental releases or sediment disturbance are either 1) not expected to overlap with the GAA spatially and temporally or 2) would not be expected to have measurable impacts on the overall water quality in the GAA as discussed in Appendix E1.

BOEM anticipates that the impacts associated with future offshore wind activities in the GAA for onshore water quality combined with ongoing activities, reasonably foreseeable environmental trends, and reasonably foreseeable activities other than offshore wind would result in **minor** adverse impacts because the effects would be small and the resource would recover completely without remedial or mitigating action.

3.21.2 Environmental Consequences

3.21.2.1 Relevant Design Parameters, Impact-Producing Factors, and Potential Variances in Impacts

This assessment analyzes the maximum-case scenario; however, there is the potential for variances in the proposed Project build-out, as defined in the PDE (see Appendix D). The Project design parameters that would influence the magnitude of the impacts on offshore waters include the number of WTGs and distance of installed IAC. Construction and operations activities for fewer WTGs and a shorter IAC distance could result in similar or lower impacts than described in Section 3.21.2.2. For onshore waters, the Project design parameters that would influence the magnitude of the impacts include the location of and construction of or within the OnSS, ICF, and landfall work area. However, EPMs implemented during both construction and decommissioning, as well as a facility-specific spill plan implemented during O&M, would decrease the potential for impacts to onshore waters. Likewise, the implementation of the Project OSRP would help minimize impacts on offshore water quality from spills. These EPMs would be implemented across all alternatives; therefore, BOEM would not expect measurable potential variances in impacts across the alternatives.

See Appendix E1 for a summary of IPFs analyzed for water quality across all action alternatives. IPFs that are either not applicable to the resource or determined by BOEM to have a negligible adverse effect are excluded from Chapter 3 and provided in Table E1-4 in Appendix E1.

Table 3.21.1 discloses IPF findings carried forward for analysis in this section. Each alternative analysis discussion consists of the construction and installation phase, the O&M phase, the decommissioning phase, and the cumulative analysis. If these analyses are not substantially different, then they are presented as one discussion.

A detailed analysis of the Proposed Action follows the table. Detailed analysis of other considered action alternatives is also provided below the table if the analysis indicates that the alternative(s) would result in substantially different impacts than the Proposed Action. Offshore and onshore IPFs are addressed separately in the analysis if appropriate for the resource; not all IPFs have both an offshore and onshore component. Where feasible, calculations for specific alternative impacts are provided in Appendix E4 to facilitate reader comparison across alternatives.

The conclusion section within each alternative analysis discussion includes a rationale for the overall impact determination. The overall impact of any alternative would be **minor** adverse because the effects would be small, and the resource would be expected to recover completely without remedial or mitigating action.

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Table 3.21-1. Alternative Comparison Summary for Water Quality

Impact-Producing Factor	No Action Alternative	Alternative B (Proposed Action) Up to 100 WTGs	Alternative C (Habitat Alternative) 64 or 65 WTGs	Alternative D (Transit Alternative) 78 to 93 WTGs	Alternative E (Viewshed Alternative) 64 or 81 WTGs	Alternative F (Higher Capacity Turbine Alternative) 56 WTGs
Accidental releases and discharges	**Offshore:** Routine spills would result in little change to water quality and would therefore be localized, short term, and **minor** adverse. In the unlikely event an allision or collision involving Project vessels or components resulted in a large spill, impacts on water quality would be **minor** to **moderate** adverse, and would range from short term to long term, depending on the type and volume of material released, the specific conditions (e.g., depth, currents, weather conditions) at the location of the spill, and effectiveness of the cleanup techniques deployed. Vessel operators would be required to comply with federal and international requirements for the management of shipboard trash and the USCG ballast water management requirements outlined in 33 CFR 151 and 46 CFR 162. Accidental releases of trash and debris would be infrequent and **negligible** adverse, and any allowed vessel discharges, such as bilge and ballast water, would be restricted to uncontaminated or appropriately treated liquids.	**Offshore**: Fuels and oils would be required for Proposed Action offshore equipment, vessels, and infrastructure. The volumes of fuels and oils and number of vessels required during O&M and decommissioning would be less than that required during construction and installation. Should a spill occur, response and containment procedures would limit the reach of the spill to a localized area, where changes to water quality would be detectable and would exceed water quality standards. As a result, adverse impacts on water quality would be short term, with spills generally dispersing within days (BOEM 2015), and **minor** to **moderate** adverse, depending on the severity of the spill. In the unlikely event an allision or collision involving Project vessels or components results in a large spill, impacts on water quality would also be **minor** to **moderate** adverse, and short term to long term, depending on the type and volume of material released and the specific conditions (e.g., depth, currents, weather conditions) at the location of the spill. Accidental releases of trash and debris would be infrequent and **negligible** adverse because Project actions would comply with federal and international requirements for management of shipboard trash and USCG regulations regarding waste and discharge. The Proposed Action could add accidental releases of fuels, oils, or hazardous material; sediment; and/or trash and debris to conditions under the No Action Alternative. BOEM estimates that the Project would result in an up-to-56% increase in total chemical usage over the No Action Alternative within the offshore water quality GAA. All vessels associated with the Proposed Action and other offshore wind projects would comply with the USCG requirements for the prevention and control of oil and fuel spills. Additionally, training and awareness of EPMs (see Table F-1 in Appendix F) proposed for waste management and mitigation of marine debris would be required of Revolution Wind Project personnel. For this reason, the Proposed Action when combined with other past, present, and reasonably foreseeable projects would result in short-term to long-term **minor** to **moderate** adverse impacts.	**Offshore:** Alternatives C through F would reduce the number of WTG foundations. This would require less fuels and oils associated with equipment, vessels, and infrastructure; less fuels and oils stored at WTGs; and less volumes of associated trash and debris. These alternatives would also likely reduce the number and duration of vessels required during construction and installation, O&M, and decommissioning activities. Under all action alternatives, Project EPMs (see Table F-1 in Appendix F), permit requirements, controls, and procedures would be implemented as part of the Project to reduce the potential or extent of offshore spills, thereby avoiding or minimizing impacts on water quality. Therefore, impacts under these alternatives would be similar to the Proposed Action: short term to long term **negligible** to **moderate** adverse. Ongoing and planned actions, including those under Alternatives C through F, would require fuels and oils. Any Project-related accidental spills or discharges, including those associated with vessel allisions or collisions, would add to water quality impacts from other planned actions, albeit at potentially slightly lower volumes than the Proposed Action under these alternatives. Therefore, Alternatives C through F when combined with past, present, and reasonably foreseeable activities would result in short-term to long-term and **minor** to **moderate** adverse cumulative impacts on water quality.			
	Onshore: Surface and groundwater bodies would be monitored and managed to meet water quality standards and drinking water resource protections. As a result, adverse impacts from future onshore wind activities supporting OSW on onshore water quality under the No Action Alternative would be short term to long term **negligible** to **minor** adverse.	**Onshore:** Revolution Wind would comply with all permit and regulatory requirements related to water quality. As a result, the adverse impact on water quality would be short term **negligible** to **minor** adverse.	**Onshore:** Alternatives C through F would not change Project onshore activities; therefore, impacts would remain the same as the Proposed Action: short term **negligible** to **minor** adverse.			

Impact-Producing Factor	**No Action Alternative**	**Alternative B (Proposed Action) Up to 100 WTGs**	**Alternative C (Habitat Alternative) 64 or 65 WTGs**	**Alternative D (Transit Alternative) 78 to 93 WTGs**	**Alternative E (Viewshed Alternative) 64 or 81 WTGs**	**Alternative F (Higher Capacity Turbine Alternative) 56 WTGs**
Anchoring and new cable emplacement/ maintenance	**Offshore:** Disturbances to the seafloor during anchoring would temporarily increase suspended sediment and turbidity levels in and immediately adjacent to the anchorage area. BOEM anticipates that future offshore wind projects would use dredging only when necessary and would rely on other cable-laying methods for reduced impacts (such as jet plow or mechanical plow) where feasible. Furthermore, these impacts from individual projects would not overlap with one another spatially or temporally. As a result, adverse impacts on offshore water quality under the No Action Alternative would be **minor** adverse and temporary.	**Offshore**: Changes to water quality would be detectable but would not result in degradation of water quality that would exceed water quality standards. As a result, adverse impacts on offshore water quality from anchoring, potential in situ munitions and explosives of concern (MEC)/UXO disposal, and cable placement activities under the Proposed Action would be **minor** adverse and temporary. BOEM estimates a cumulative total of 7,143 acres of cabling-related disturbance for the Proposed Action plus all other future offshore wind projects and 3,876 acres of anchoring-related disturbance for the Proposed Action plus all other future offshore wind projects. Suspended sediment concentrations during activities other than dredging would be within the range of natural variability typical for the affected area. Therefore, the Proposed Action when combined with past, present, and reasonably foreseeable projects would result in short-term **mino**r adverse cumulative impacts to water quality.	**Offshore:** Alternatives C through F would reduce the number of WTGs and scour protections associated with IACs. This would require fewer seafloor disturbances during construction and installation, O&M and decommissioning; however, the types and extent of seafloor disturbances would be similar, and the impacts on water quality would be comparable. As a result, impacts to water quality under the Habitat Alternative would be similar to the Proposed Action: **minor** adverse and temporary. Total anchoring and cabling seafloor disturbance that could occur from ongoing and planned actions, including those actions under Alternatives C through F, would be similar but slightly reduced from the Proposed Action. Project-related seafloor disturbances would add to water quality impacts. Therefore, Alternatives C through F when combined with past, present, and reasonably foreseeable activities would result in short-term and **minor** adverse cumulative impacts on water quality.			
	Onshore: Degradations to onshore water quality from future onshore activities would be localized and temporary to long term, depending on the nature of the activities, although overall water quality is expected to continue to meet Rhode Island water quality standards (250 RICR 150.05). As a result, adverse impacts from future activities on onshore water quality under the No Action Alternative would be temporary to long term **negligible** to **minor** adverse**.**	**Onshore:** The implementation of EPMs in Table F-1 in Appendix F would avoid or minimize impacts on water quality, and Revolution Wind would comply with all permit and regulatory requirements related to water quality. As a result, adverse impacts on onshore water quality under the Proposed Action would be short term **negligible** to **minor** adverse.	**Onshore:** Alternatives C through F would not change Project onshore activities; therefore, impacts would remain the same as the Proposed Action: short term **negligible** to **minor** adverse.			
Port utilization	**Offshore:** Port activities could increase vessel traffic, suspension and turbidity from in-water work, and the risk of accidental spills or discharges. However, these actions would be localized, and port improvements would comply with all applicable permit requirements to minimize, reduce, or avoid impacts on water quality. As a result, adverse impacts on offshore water quality under the No Action Alternative would be short term to long term **minor** adverse.	**Offshore:** Port-related actions would be localized, and port activities would comply with all applicable permit requirements to minimize, reduce, or avoid impacts on water quality. As a result, adverse impacts on offshore water quality under the Proposed Action would be short to long term but **minor** adverse. Cumulative impacts associated with the Proposed Action and past, present, and reasonably foreseeable future activities would be **negligible** to **minor** adverse.	**Offshore:** The types and extent of port activities under Alternatives C through F would be the same as described for the Proposed Action. Therefore, impacts would be short to long term but **minor** adverse. Cumulative impacts associated with Alternatives C through F and past, present, and reasonably foreseeable future activities would be the same as described for the Proposed Action: **negligible** to **minor** adverse.			
	Onshore: Future expansion or modification of existing ports in addition to increased use could increase land disturbance and the risk of accidental spills or discharges. However, these actions would be localized, and port improvements would comply with all applicable permit requirements to minimize, reduce, or avoid impacts on water quality. As a result, adverse impacts on onshore water quality under the No Action Alternative would be short to long term but **negligible** to **minor** adverse.	**Onshore:** The implementation of EPMs in Table F-1 in Appendix F would avoid or minimize impacts on water quality, and Revolution Wind would comply with all permit and regulatory requirements related to water quality. As a result, adverse impacts on onshore surface water quality under the Proposed Action would be temporary to short term **negligible** to **minor** adverse.	**Onshore:** Alternatives C through F would not change Project onshore activities; therefore, impacts would remain the same as the Proposed Action: temporary to short term **negligible** to **minor** adverse.			

Impact-Producing Factor	No Action Alternative	Alternative B (Proposed Action) Up to 100 WTGs	Alternative C (Habitat Alternative) 64 or 65 WTGs	Alternative D (Transit Alternative) 78 to 93 WTGs	Alternative E (Viewshed Alternative) 64 or 81 WTGs	Alternative F (Higher Capacity Turbine Alternative) 56 WTGs
Presence of structures	**Offshore:** Structures could disturb seafloor within the water quality GAA from foundation and scour protection installation and disrupt bottom current patterns, leading to increased movement, suspension, and deposition of sediments. BOEM anticipates that developers would implement best management practices to minimize seafloor disturbance from foundations, scour, and cable installation. As a result, impacts on offshore water quality under the No Action Alternative would be localized, short term, and **minor** adverse.	**Offshore:** BOEM estimates that the Project would result in an up-to-50% increase in total structures over the No Action Alternative within the offshore water quality GAA. EPMs in Table F-1 in Appendix F would be implemented to minimize seafloor disturbance from foundations and scour. As a result, adverse impacts on offshore water quality under the Proposed Action would be short term **minor** adverse. Because of the limited extent of impacts and BOEM's expectation that Revolution Wind and other developers would comply with all applicable permit requirements to minimize, reduce, or avoid impacts on water quality, the Proposed Action when combined with past, present, and reasonably foreseeable projects would also result in **minor** adverse and long-term impacts to water quality.	**Offshore:** Alternatives C through F would reduce the number of WTGs and scour protection associated with foundations. This would require fewer acres of seafloor disturbance during construction and installation, O&M, and decommissioning that could disrupt bottom current patterns and lead to scouring; however, the types of seafloor disturbance and changes to patterns and flows would be similar. For comparison, Alternatives C and E would reduce seafloor disturbance by up to 35%, Alternative D would reduce seafloor disturbance by up to 21.5%, and Alternative F would reduce seafloor disturbance by up to 43%, as compared to the maximum-case scenario for the Proposed Action. Implementation of Alternative F in conjunction with Alternatives C, D, and E would further reduce seafloor disturbance for these alternatives by up to 8%, 21.5%, and 8%, respectively. As a result, impacts to offshore water quality under Alternatives C through F would be similar to the Proposed Action: short term **minor** adverse. See Table E-4 in Appendix E for foundation construction footprint calculations per alternative. Alternatives C through F would result in an up-to-27 to 45% increase in structures from the No Action Alternative. New structures related to Alternatives C through F would add to seafloor disturbances and disruptions to bottom current patterns that would lead to scouring and associated water quality impacts. However, for similar reasons as the Proposed Action, Alternatives C through F when combined with past, present, and reasonably foreseeable activities would result in long-term and **minor** adverse cumulative impacts on water quality.			
	Onshore: The presences of structures from future onshore activities supporting OSW would result in an increase in impervious surfaces that could contribute to stormwater runoff to nearby waterbodies. These activities would be expected to comply with any applicable permit requirements to implement erosion and stormwater controls to minimize, reduce, or avoid impacts on water quality. As a result, adverse impacts on onshore water quality under the No Action Alternative would be short to long term **negligible** to **minor** adverse**.**	**Onshore:** The implementation of EPMs in Table F-1 in Appendix F would avoid or minimize impacts on water quality, and Revolution Wind would comply with all permit and regulatory requirements related to water quality. As a result, impacts on onshore water quality under the Proposed Action would be localized, short term, and **negligible** to **minor** adverse.	**Onshore:** Alternatives C through F would not change Project onshore activities; therefore, impacts would remain the same as the Proposed Action: short term **negligible** to **minor** adverse.			

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3.21.2.2 Alternative B: Impacts of the Proposed Action on Water Quality

3.21.2.2.1 Construction and Installation

Offshore Activities and Facilities

Accidental releases and discharges: Fuels and oils would be required for Proposed Action offshore construction and installation equipment, vessels, and infrastructure over the 18-month construction and installation period. In the event of a spill or release during construction and installation activities, offshore water quality would be degraded. Most inadvertent spills of fuels and oils used during construction and installation would be classified as routine and minor adverse because of their size (i.e., spills less than 10 barrels, or 420 gallons) and rapid dispersion (BOEM 2015). As described in Section 3.21.1.2, the likelihood of a spill due to construction and installation activities and weather events is low (once per 1,000 years). A draft OSRP has been prepared for the Project and includes processes for rapid spill response, containment, cleanup, and other measures that would help minimize impacts on water quality from spills (see COP Appendix D).

Fuels and oils would be used and stored at WTGs and OSSs. A maximum of approximately 7,530 gallons of coolants, fuels, oils and lubricants would be stored at each WTG (or a total of approximately 753,000 gallons for the maximum 100 proposed WTGs), and a maximum of 132,400 gallons of fuels, oils, and lubricants would be stored at each OSS (or a total of approximately 264,800 gallons for the two proposed OSSs). Secondary containment measures would be implemented for all diesel tanks at WTGs (vhb 2022). Under the Proposed Action, the highest possible spill would be the inadvertent release of fuels and oils stored at WTGs and OSSs, which would contain up to 1,018,000 gallons of fuels and oils. Project EPMs (see Table F-1 in Appendix F), permit requirements, controls, and procedures would be implemented as part of the Project to reduce the potential or extent of offshore spills, thereby avoiding or minimizing impacts on water quality. Should a spill occur, response and containment procedures would limit the reach of the spill to a localized area, where changes to water quality would be detectable and would exceed water quality standards. As a result, adverse impacts on water quality would be short term, with spills generally dispersing within days (BOEM 2015), and **minor** to **moderate** adverse, depending on the severity of the spill.

Construction of the Proposed Action would require as many as 61 vessels. Vessels would be equipped with spill containment and cleanup materials, and any accidental spill or release of fuels, oils, or other hazardous materials would be managed through the Project's OSRP (vhb 2022). All construction-related vessels would be required to comply with regulatory requirements related to the prevention and control of spills and discharges (vhb 2022). The chance of a spill occurring due to vessel allisions or collisions would be low (once per 1,000 years). In the unlikely event an allision or collision involving Project vessels or components results in a large spill, impacts on water quality would be **minor** to **moderate** adverse, and short term to long term, depending on the type and volume of material released and the specific conditions (e.g., depth, currents, weather conditions) at the location of the spill.

The Proposed Action could also result in accidental releases of trash and debris from vessels or in situ MEC/UXO disposal into offshore waters. EPMs in Table F-1 in Appendix F would be implemented to avoid or minimize impacts on water quality from releases of trash or debris. Accidental releases of trash and debris would be infrequent and **negligible** adverse because vessels would comply with federal and international requirements for management of shipboard trash and USCG regulations regarding waste and discharge. Foreign-flagged vessels would also have a USCG-compliant and certified ballast water management system. Any allowed vessel discharges, such as bilge and ballast water, would be restricted to uncontaminated or appropriately treated liquids. Should an accidental release occur, it would be limited to the localized area; adverse impacts on water quality would be short term **minor** to **moderate** adverse.

Existing restoration and protection initiatives established for offshore areas, including those developed as part of the Long Island Sound Study initiative (Long Island Sound Study 2021), Bay Assessment & Response Team (Rhode Island DEM 2021c), Rhode Island Beach Monitoring Program (Rhode Island Department of Health 2021), and Rhode Island Environmental Monitoring Collaborative (RIEMC 2021), would help identify and manage water quality degradations, should they occur.

Anchoring and new cable emplacement/maintenance: Approximately 3,178 acres and 4,009 acres of seafloor could be impacted by anchoring and cable placement, respectively, under the Proposed Action within the offshore water quality GAA. Potential in situ MEC/UXO disposal could also result in sediment suspension and disturbance. Disturbances to the seafloor would temporarily increase suspended sediment and turbidity levels in and immediately adjacent to the anchorage, disposal, or cable placement area. Sediment modeling completed for the Proposed Action indicates that sediment suspension and deposition would occur during in-water offshore activities (RPS 2022). The modeling showed that in most locations the total suspended solids plumes are limited to the bottom 10 feet of the water column and are temporary at any given location. Suspended sediments would settle within hours or days, including up to 6.7 hours in the RWF IAC, 61 hours in the RWEC-OCS, approximately 70 hours along the RWEC-RI, and 70 hours at the landing site where HDD would occur.

EPMs in Table F-1 in Appendix F would avoid or minimize impacts on water quality, and Revolution Wind would comply with all permit and regulatory requirements related to water quality. Changes to water quality would be detectable but would not result in degradation of water quality that would exceed water quality standards. As a result, adverse impacts on offshore water quality from anchoring and cable placement activities under the Proposed Action would be **minor** adverse and temporary.

Port utilization: The Project would use nearby ports for a construction hub, for WTG storage and pre-commissioning, and for foundation marshalling and fabrication. These activities would result in increased vessel traffic and increased in-water activities, which would contribute to increased suspension and turbidity. As many as 61 vessels would be required during construction and installation. These activities could also increase the risk of accidental spills or discharges. Port-related actions would be localized, and port activities would comply with all applicable permit requirements to minimize, reduce, or avoid impacts on water quality. In addition, EPMs in Table F-1 in Appendix F would avoid or minimize impacts on water quality. As a result, adverse impacts on offshore water quality under the Proposed Action would be short to long term but **minor** adverse.

It is not known at this time if port expansions or modifications would be required for the Proposed Action (vhb 2022). If so, these activities would require in-water work, including vessel use, that would increase sediment suspension and turbidity. Impacts from these activities would be similar to those described above for port uses.

Presence of structures: The Proposed Action would result in up to 100 monopile foundations for WTGs and two monopile foundations for OSSs within the GAA for offshore water quality. These structures could temporarily disturb up to approximately 720 acres (7.2 acre per foundation) during seafloor preparation. Foundations would encompass a total footprint of approximately 71 acres (0.7 acre per foundation) of seafloor disturbance and scour protection. Seafloor disturbance would occur from foundation and scour protection installation, and the presence of structures would disrupt bottom current patterns and lead to increased movement, suspension, and deposition of sediments. Project-related scouring could impact water quality through the formation of sediment plumes, and structures could reduce wind-forced mixing of surface waters. Flows around foundations could increase vertical mixing of the water column. These changes in currents and mixing would affect water quality but would vary seasonally and regionally. EPMs in Table F-1 in Appendix F would be implemented to minimize seafloor disturbance from foundations and scour, including the installation of scour protection and cable armoring where burial is not possible, that would avoid or minimize impacts on water quality, and Revolution Wind would comply with all permit and regulatory requirements related to water quality. As a result, adverse impacts on offshore water quality under the Proposed Action would be localized, short term, and **minor** adverse.

Onshore Activities and Facilities

<u>Accidental releases and discharges:</u> Onshore facilities would not cross surface waterbodies. Onshore construction equipment, vehicles, and infrastructure under the Proposed Action would require fuels and oils during the construction and installation period. Although unlikely due to distance to closest stream of 200 feet, any inadvertent spills occurring during construction and installation, such as the release of fuels and oils from vehicles or infrastructure, would be classified as routine and minor adverse (BOEM 2015).

Table F-1 in Appendix F includes EPMs to avoid or minimize potential spill impacts on water quality, to comply with all general construction permit requirements, and to implement runoff controls and buffers. In addition, Revolution Wind would develop and implement a stormwater pollution prevention plan and HDD inadvertent release plan to protect nearby surface waters. Although these procedures would reduce the likelihood and extent of routine spills, spills in or near surface waterbodies would contribute to detectable changes that could result in an exceedance of water quality standards. Therefore, the adverse impact on water quality would be short term **minor** adverse.

There are no groundwater resources crossed by the Project. As described in Section 3.21.1.3, the nearest groundwater recharge area would be approximately 1.2 miles from the Project. At this distance, the risk of any inadvertent spill or release to groundwater during construction and installation of the Project would be **negligible** adverse.

<u>New cable emplacement/maintenance</u>: The Project would require the installation of permanent (over the life of the Project) onshore export cable (i.e., the RWEC). This activity would require temporary (up to 18 months) ground-disturbing activities including surficial digging, land clearing, trenching, HDD, and use of equipment and vehicles. The RWEC route does not directly intersect any surface waterbody; however, surface disturbance associated with installation could contribute to erosion and sedimentation in nearby surface waterbodies, thereby leading to changes in water quality. Overall construction activities and Project infrastructure would disturb more than 1 acre, and discharges would therefore need to be permitted through a general construction permit under the NPDES program. Revolution Wind would also develop a stormwater pollution prevention plan as part of the permitting process that would result in implementation of erosion and sediment controls prior to and during construction and installation. EPMs in Table F-1 in Appendix F would avoid or minimize impacts on water quality, and Revolution Wind

would comply with all permit and regulatory requirements related to water quality. As a result, adverse impacts on onshore water quality under the Proposed Action would be localized, short term, and **negligible** to **minor** adverse.

The distance between Project-related land-disturbing activities and the nearest groundwater recharge area (1.2 miles) would result in **negligible** adverse risks of a spill or release reaching groundwater resources.

<u>Port utilization:</u> The Project would use nearby ports to support construction and installation of the Proposed Action. Increased use and related activities at ports could increase the risk of accidental spills or discharge to nearby surface waterbodies. Inadvertent spills or releases during construction and installation would be classified as routine and would be localized, short term, and minor adverse. It is not known at this time if port expansions or modifications would be required. If so, these activities would require surface disturbances that would contribute to erosion and sedimentation in nearby surface waterbodies, thereby leading to changes to water quality.

EPMs in Table F-1 in Appendix F would avoid or minimize impacts on water quality, and Revolution Wind would comply with all permit and regulatory requirements related to water quality. As a result, adverse impacts on onshore surface water quality under the Proposed Action would be temporary and **negligible** to **minor** adverse. No impacts on groundwater are anticipated from port use during onshore construction and installation because there would be no required surface disturbance that could encounter groundwater or result in water quality degradations through runoff into groundwater recharge areas.

<u>Presence of structures:</u> The presence of structures from the Proposed Action would result in an increase in impervious surfaces (20 acres) that could contribute to stormwater runoff to nearby surface waterbodies. The OSS would encompass approximately 16 acres, and the onshore ICF would temporarily encompass approximately 4 acres. Fill materials would be used for installation of structures. None of the onshore facilities of the RWEC route directly intersect any surface waterbody; however, surface disturbance associated with installation of onshore facilities could contribute to erosion and sedimentation in nearby surface waterbodies, thereby leading to changes in water quality. EPMs in Table F-1 in Appendix F would avoid or minimize impacts on water quality, and Revolution Wind would comply with all permit and regulatory requirements related to water quality. As described under the new cable emplacement/maintenance IPF, discharges would be permitted through a general construction permit under the NPDES program. Revolution Wind would also develop a stormwater pollution prevention plan as part of the permitting process that would result in implementation of erosion and sediment controls prior to and during construction and installation. As a result, impacts on onshore water quality under the Proposed Action would be localized, short term, and **negligible** to **minor** adverse. The distance between Project-related land-disturbing activities and the nearest groundwater recharge area (1.2 miles) would result in minimal risk of runoff reaching groundwater resources; **negligible** adverse impacts on groundwater are anticipated from the presence of structures during onshore construction and installation.

3.21.2.2.2 Operations and Maintenance and Decommissioning

Offshore Activities and Facilities

<u>Accidental releases and discharges:</u> O&M and decommissioning of the offshore portion of the Project would lead to similar adverse impacts on water quality from inadvertent spills or releases that could occur during construction and installation. The volumes of fuels and oils and number of vessels required during

O&M and decommissioning would be less than that required during construction and installation (vhb 2022). The same Project features and EPMs described for offshore construction and installation (see Section 3.21.2.2.1) would be implemented during O&M and decommissioning to avoid or minimize potential spill impacts on water quality. Most inadvertent spills of fuels and oils used during O&M and decommissioning would be classified as routine and minor adverse. Should a routine spill occur, it would be temporarily detectable and would disperse rapidly, thereby limiting the magnitude and extent of changes to water quality. Therefore, changes to water quality would be localized, short term, and **minor to moderate** adverse, depending on the severity of potential spills or releases.

<u>Anchoring and new cable emplacement/maintenance:</u> Anchoring and cable-related activities during O&M and decommissioning would contribute to changes in offshore water quality from the resuspension and deposition of sediment. O&M and decommissioning of the offshore portion of the Project would lead to similar minor adverse and temporary adverse impacts on water quality from anchoring and new cable emplacement and maintenance that would occur during construction and installation. Fewer anchoring activities would occur during O&M and decommissioning activities compared to construction and installation. Cable activities would also be less frequent during O&M and decommissioning and would typically include maintenance activities that would result in less seafloor disturbance than installation activities during construction and installation. EPMs in Table F-1 in Appendix F would avoid or minimize impacts on water quality, and Revolution Wind would comply with all permit and regulatory requirements related to water quality. As described for construction and installation (see Section 3.21.2.2.1), suspended sediments would typically settle within hours or days, and the extent of deposition would be limited. Changes to water quality from anchoring and cable activities would be detectable but would not result in degradation of water quality that would exceed water quality standards. As a result, adverse impacts on offshore water quality under the Proposed Action would be **minor** adverse and temporary.

<u>Port utilization:</u> The Project would use nearby ports to support O&M and decommissioning of the Project. As described under offshore construction and installation, these activities would result in increased vessel traffic and increased in-water activities, which would contribute to increased suspension and turbidity. Up to 16 vessels would be required during O&M and decommissioning. These activities could also increase the risk of accidental spills or discharges. See offshore activities and facilities analysis in Section 3.21.2.2.1 for details. As a result, adverse impacts on offshore water quality under the Proposed Action would be short to long term but **minor** adverse.

<u>Presence of structures:</u> O&M would not result in additional structures that would lead to impacts on water quality. During decommissioning, structures would be removed to a depth of 15 feet below the seafloor (vhb 2022), which would reduce in-water structures that have disrupted bottom current patterns and led to scouring (as described for construction and installation). Water quality during O&M would remain the same, whereas water quality during decommissioning could result in short-term changes to water quality; however, these changes would be limited in terms of duration and extent (similar to those described for construction and installation of structures). See offshore activities and facilities analysis in Section 3.21.2.2.1 for details. As a result, adverse impacts on offshore water quality under the Proposed Action would be short term **minor** adverse.

Onshore Activities and Facilities

Accidental releases and discharges: O&M activities would require vehicles and equipment that require the use of fuels, oils, and lubricants. The volumes of fuels and oils and number of vehicles required during O&M and decommissioning would be less than that required during construction and operations (vhb 2022). Although unlikely due to distance to closest surface waterbody of 200 feet, any inadvertent spills in onshore waters during O&M or decommissioning would be classified as routine and **minor** adverse (BOEM 2015). See onshore activities and facilities analysis in Section 3.21.2.2.1 for details. As a result, adverse impacts on onshore surface water quality under the Proposed Action would be short term **minor** adverse. Similar to onshore construction and installation, O&M and decommissioning activities would be distanced far enough from groundwater recharge areas (at least 1.2 miles) that the risk of a spill or release reaching groundwater resources would be **negligible** adverse.

New cable emplacement/maintenance: O&M would require limited land disturbance should maintenance be required for underground infrastructure (i.e., transmission cable). Decommissioning of the onshore portion of the Project would lead to the same types of impacts on surface water quality from erosion, sedimentation as described under construction and installation. See onshore activities and facilities analysis in Section 3.21.2.2.1 for details. As a result, adverse impacts on offshore water quality under the Proposed Action would be temporary and **negligible** to **minor** adverse.

The distance between Project-related land-disturbing activities and the nearest groundwater recharge area (1.2 miles) would result in limited risks of a spill or release reaching groundwater resources; **negligible** adverse impacts on groundwater are anticipated from land disturbance during onshore O&M and decommissioning.

Port utilization: The Project would use nearby ports to support O&M and decommissioning of the Project. As described for onshore construction and installation, increased use and related activities at ports could increase the risk of accidental spills or discharge to nearby surface waterbodies. See onshore activities and facilities analysis in Section 3.21.2.2.1 for details. As a result, adverse impacts on onshore surface water quality under the Proposed Action would be temporary and **minor** adverse. **Negligible** adverse impacts on groundwater are anticipated from port use during onshore construction and installation because there would be no required surface disturbance that could encounter groundwater or result in water quality degradations through runoff into groundwater recharge areas.

Presence of structures: O&M would not result in additional structures that would lead to impacts on water quality. During decommissioning, structures would be removed in compliance with applicable laws and regulations at that time (vhb 2022). Water quality during O&M and decommissioning would remain the same, whereas water quality during decommissioning could result in short-term changes to water quality; however, these changes would be limited in terms of duration and extent (similar to those described for construction and installation of structures). See onshore activities and facilities analysis in Section 3.21.2.2.1 for details. As a result, adverse impacts on offshore water quality under the Proposed Action would be short term **negligible** to **minor** adverse.

3.21.2.2.3 Cumulative Impacts

Offshore Activities and Facilities

Accidental releases and discharges: The Proposed Action could noticeably add accidental releases of fuels, oils, or hazardous material; sediment; and/or trash and debris to conditions under the No Action Alternative. BOEM estimates that the Project would result in an up-to-56% increase in total chemical usage over the No Action Alternative within the offshore water quality GAA. This risk would be increased primarily during construction and installation, O&M, and decommissioning. When the Project is combined with other offshore wind projects, up to approximately 2.8 million gallons of coolants, fuels, oils, and lubricants could cumulatively be stored within WTG foundations and the OSS within the offshore water quality GAA. All vessels associated with the Proposed Action and other offshore wind projects would comply with the USCG requirements for the prevention and control of oil and fuel spills. Additionally, training and awareness of EPMs (see Table F-1 in Appendix F) proposed for waste management and mitigation of marine debris would be required of Revolution Wind Project personnel. These releases, if any, would occur infrequently at discrete locations and vary widely in space and time. For this reason, the Proposed Action when combined with other past, present, and reasonably foreseeable projects would result in short-term to long-term **minor** to **moderate** adverse impacts.

Anchoring and new cable emplacement/maintenance: The Proposed Action would result in localized, temporary, and minor incremental impacts to water quality through an estimated 3,178 acres of anchoring and mooring-related disturbance. The Proposed Action would add to the estimated 698 acres of seafloor that could be impacted by anchoring from other reasonably foreseeable offshore wind activities. This would result in a cumulative total of 3,876 acres of anchoring-related disturbance for the Proposed Action, plus all other future offshore wind projects. Therefore, the Proposed Action when combined with past, present, and reasonably foreseeable projects would result in **minor** adverse cumulative impacts to water quality.

The Proposed Action would result in localized, short-term, and minor adverse impacts to water quality through an estimated 4,009 acres of seafloor disturbance from cable installation, which would temporarily increase suspended sediment and turbidity levels in and immediately adjacent to anchorage areas. This would result in additional turbidity effects, increasing seafloor disturbance due to cable installation, when compared to the No Action Alternative. BOEM estimates a cumulative total of 7,143 acres of cabling-related disturbance for the Proposed Action plus all other future offshore wind projects. Sediment modeling for the Proposed Action indicates that sediment suspension and deposition would occur within an area of up to 328 feet and would settle shortly (hours to days) after the release of sediment (Vinhateiro et al. 2018). Suspended sediment concentrations during activities other than dredging would be within the range of natural variability typical for the affected area. As a result, the Proposed Action when combined with past, present, and reasonably foreseeable projects would result in **minor** adverse cumulative impacts to water quality.

Port utilization: BOEM expects impacts to water quality due to the increase in port use resulting from the Proposed Action to be negligible to minor adverse. Other offshore wind development would use nearby ports and could also require port expansion or modification. However, Revolution Wind and all other developers would comply with all permit requirements to avoid or minimize water quality impacts. Therefore, cumulative impacts associated with the Proposed Action and past, present, and reasonably foreseeable future activities would be **negligible** to **minor** adverse.

Presence of structures: The Proposed Action would result in long-term and minor adverse impacts to water quality through the installation of 102 structures (100 WTGs and two OSSs). This represents a 50% increase over total estimated WTG and OSS foundations under the No Action Alternative within the offshore water quality GAA. BOEM estimates a cumulative total of 307 structures for the Proposed Action plus all other future offshore wind projects within the offshore water quality GAA. These additional structures could cumulatively add to other offshore impacts to water quality from turbidity due to scour and water current alteration. However, because of the limited extent of impacts and BOEM's expectation that Revolution Wind and other developers would comply with all applicable permit requirements to minimize, reduce, or avoid impacts on water quality, the Proposed Action when combined with past, present, and reasonably foreseeable projects would result in **minor** adverse and long-term impacts to water quality.

Onshore Activities and Facilities

Accidental releases and discharges: The Proposed Action would result in negligible to minor adverse onshore water quality impacts on surface water due to discharges and due to dispersal of contaminants during routine spills or inadvertent releases. State and local agencies would be responsible for minimizing and avoiding water quality and other impacts during construction and installation. The Project and other reasonably foreseeable projects would be expected to comply with any applicable permit requirements to implement erosion, stormwater, and spill controls to minimize, reduce, or avoid impacts on water quality. As a result, the Proposed Action when combined with past, present, and other reasonably foreseeable projects would result in short-term impacts and **negligible** to **minor** adverse cumulative impacts on onshore water quality.

New cable emplacement/maintenance: The Proposed Action would result in negligible to minor adverse impacts to onshore water quality impacts on surface water and groundwater due to erosion and sedimentation. State and local agencies would be responsible for minimizing and avoiding water quality and other impacts during construction and installation. The Project and other reasonably foreseeable projects would be expected to comply with any applicable permit requirements to implement erosion, stormwater, and spill controls to minimize, reduce, or avoid impacts on water quality. As a result, the Proposed Action when combined with past, present, and other reasonably foreseeable projects would result in short-term impacts and **negligible** to **minor** adverse cumulative impacts on onshore water quality.

Port utilization: The Proposed Action would result in minor adverse impacts to onshore water quality due to changes in surface water quality from increased port-related traffic. The Proposed Action would also add to the increased the risk of accidental spills or discharges. Other offshore wind development would also use nearby ports. Revolution Wind and all other developers would comply with all permit requirements to avoid or minimize water quality impacts. As a result, the Proposed Action when combined with past, present, and other reasonably foreseeable projects would result in short-term impacts and **negligible** to **minor** adverse cumulative impacts on onshore surface water quality. The Proposed Action would not contribute to impacts on groundwater quality.

Presence of structures: The Proposed Action would result in temporary and minor adverse impacts to water quality related to the presence of structures, which would also result in an increase in impervious surfaces (19 acres) through the development of 20 acres for the OnSS and ICF. Other offshore wind development would also include the construction and installation of structures and associated impacts to onshore water quality. These additional structures could cumulatively add to other onshore impacts to water quality from turbidity due to scour and water current alteration. However, because of the limited extent of impacts and BOEM's expectation that Revolution Wind and other developers would comply with all applicable permit requirements to minimize, reduce, or avoid impacts on water quality, the Proposed Action when combined with past, present, and reasonably foreseeable projects would result in **negligible** to **minor** adverse short-term impacts to water quality.

3.21.2.2.4 Conclusions

Although Project construction and installation, O&M, and decommissioning would expose and disturb soils and sediments, onshore facilities would not cross surface waterbodies. Therefore, impacts to water quality from potential erosion, sedimentation, or inadvertent release of contamination or hazardous materials or debris into onshore surface waters are not anticipated and would be short term **negligible** to **minor** adverse. Offshore, Project construction and installation and decommissioning would contribute to increased movement, suspension, and deposition of sediments; changes to water column stratification; and mixing patterns that would affect water quality parameters. Impacts from Project O&M would be much lower than those produced during construction and installation and decommissioning but could also result in erosion, sediment resuspension, deposition, and inadvertent spills. BOEM anticipates that the impacts resulting from the Proposed Action alone would range from **negligible** to **moderate** adverse. Therefore, BOEM expects the overall impact on water quality from the Proposed Action alone to be **minor** adverse because the effect would be small and the resource would be expected to recover completely without remedial or mitigating action. The Proposed Action would not result in any net beneficial change to water quality.

In the context of other reasonably foreseeable environmental trends and planned actions, the impacts under the Proposed Action resulting from individual IPFs would range from **negligible** to **moderate** adverse. Considering all the IPFs together, BOEM anticipates that the overall impacts associated with the Proposed Action when combined with past, present, and reasonably foreseeable activities would result in **minor** adverse impacts to water quality because the effect would be small and the resource would be expected to recover completely. The Proposed Action would not result in benefits to water quality.

3.21.2.3 Alternatives C, D, E, and F

Table 3.21.1 discloses IPF findings for each alternative.

3.21.2.3.1 Conclusions

Although Alternatives C through F would reduce the number of WTGs and their associated IACs offshore, which would have an associated reduction in potential changes to movement, suspension, and deposition of sediments; water column stratification; and mixing patterns, BOEM expects that the impacts resulting from each alternative alone would be similar to the Proposed Action and range from **negligible** to **moderate** adverse. Alternatives C through F would not result in any change to onshore water quality as compared to the Proposed Action and would not result in any net beneficial change to water quality.

In the context of other reasonably foreseeable environmental trends and planned actions, BOEM also expects that Alternatives C through F's impacts would be similar to the Proposed Action (with individual IPFs leading to impacts ranging from **negligible** to **moderate** adverse). The overall impacts of each alternative when combined with past, present, and reasonably foreseeable activities would be the same level as under the Proposed Action: **minor** adverse. Alternatives C through F would not result in benefits to water quality.

3.21.2.4 Mitigation

No potential additional mitigation measures for water quality are identified in Table F-2 in Appendix F.

3.22 Wetlands and Other Waters of the United States

3.22.1 Description of the Affected Environment and Environmental Consequences of the No Action Alternative for Wetlands and Other Waters of the United States

Geographic analysis area: The GAA for wetlands and other waters of the United States (WOTUS) is the Lower West Passage subwatershed (Hydrologic Unit Code 010900040908), which overlaps the onshore Project and is the same as the GAA for onshore water quality (see Figure 3.21-2). This area encompasses the drainage basin and network of surface waterbodies that could be affected by Project activities.

Affected environment: Freshwater and tidal wetlands, lakes and ponds, streams, and other WOTUS are found throughout the GAA (see Figure 3.21-2). Wetlands resources and their functions and values are described in Sections 1.3.2 and 3.1.2 of COP Appendix K (vhb 2021). As mapped by the USFWS National Wetlands Inventory, approximately 1,268.1 acres of freshwater forest/shrub wetlands and 99.3 acres of freshwater emergent wetlands are found near streams, lakes, and ponds throughout the GAA. In addition, estuarine and marine wetland habitat is found in tidal areas near the shore of Narragansett Bay.

WOTUS are subject to USACE jurisdiction under Section 404 of the federal Clean Water Act (CWA). However, as described in COP Appendix K, wetland resources also fall under the jurisdiction of the State of Rhode Island following pre-determined physical boundaries mapped on the Rhode Island DEM’s Environmental Resource Map. Based on this map, the onshore Project components are to be located almost entirely within the jurisdiction of the RI CRMC with the exception of a potential segment of an onshore transmission cable route along Roger Williams Way between Mainsail Drive and Circuit Drive, where the jurisdictional WOTUS boundary follows Roger Williams Way (vhb 2021). Under the RI CRMC Coastal Resources Management Program-Rules and Regulations Governing the Protection and Management of Freshwater Wetlands in the Vicinity of the Coast (Freshwater Wetland Rules; 650-RICR-20-00-2), wetlands receive a buffer of 50 feet from the delineated edge of the wetland. The area of land within 50 feet is regulated as a separate wetland resource (RI CRMC 2011).

Freshwater and tidal wetlands (e.g., tidal salt marsh, ruderal forested wetland, ruderal shrub marsh, and vernal pools) were observed in the GAA during the field surveys (vhb 2021). Wetlands and streams delineated within the footprint of onshore Project components and the adjacent areas are shown on Figures 4.3.1-3 and 4.3.1-13 in COP Appendix K. All wetlands, buffers, and ditches within the footprint are regulated by RI CRMC, as summarized in Table 3.22-1. Potentially jurisdictional WOTUS are located outside the footprint of onshore Project components.

Table 3.22-1. Delineated Wetlands by Project Component

Project Component	Freshwater Wetlands (acres)*	Wetland Buffer (acres)†	Regulated Ditch (feet)‡	Waters of the United States
Landfall work area	0	0	0	0
OnSS footprint	< 0.01	0.48	0	0
ICF footprint	0.10	0.24	148.38	0
Onshore cable corridor and envelope	0	0.07	0	0

Source: vhb (2021).

* Freshwater wetlands regulated by RI CRMC based on Environmental Resource Map.

† Area of land within 50 feet of the wetland boundary regulated by RI CRMC.

‡ Human-made ditch that is regulated by RI CRMC as an Area Subject to Stormwater Flowage.

The landfall work area was shifted east to avoid a delineated ruderal forested wetland (Freshwater Wetland 1) that is regulated by the RI CRMC as a freshwater wetland near the coast. Tidal salt marshes west of the landfall work area have also been avoided. There are no wetlands or WOTUS within the onshore transmission cable corridor or easement. However, the cable corridor crosses the 50-foot wetland buffer of Freshwater Wetland 1.

Regulated wetlands within and adjacent to the OnSS and ICF parcels include four freshwater wetlands (Freshwater Wetlands 2–5), tributaries to Mill Creek, and a human-made ditch. Freshwater Wetland 2 (i.e., a small isolated forested wetland) is outside of but adjacent to the OnSS footprint. Freshwater Wetland 3 (i.e., a forested swamp) occurs along the western boundary of the OnSS parcel and continues off-site around Mill Creek. Freshwater Wetland 4 (i.e., a shrub marsh with a forested perimeter) occurs along the northern boundary of the OnSS and ICF parcel. Wetland 5 is a small, isolated scrub-shrub wetland within the ICF footprint that is hydrologically connected to Freshwater Wetland 4 by a human-made ditch that is regulated as an Area Subject to Stormwater Flowage. Tributaries to Mill Creek flow north and west through Freshwater Wetland 3, outside the OnSS footprint (see Figures 4.3.1-3 and 4.3.1-13 in COP Appendix K). Vernal pools were identified within Freshwater Wetlands 4 and 5. The OnSS and ICF footprints are designed to avoid most of the 3.92 acres of wetlands delineated within these parcels.

Warming temperatures, increasing storm severity and frequency, and ongoing rising sea levels impact wetland habitats. Large, severe storms can increase sedimentation and erosion, which can lead to habitat alteration. Offshore wind projects aim to combat climate change and associated effects by reducing GHG emissions.

3.22.1.1 Future Offshore Wind Activities (without Proposed Action)

This section discloses potential impacts to state regulated wetland resources (i.e., freshwater wetlands, buffer, and ditches) and nearby federally regulated WOTUS associated with future offshore wind development. In this and the following sections, the state wetlands and federal WOTUS are collectively referred to as *wetland resources*. Analysis of impacts associated with ongoing activities and future non–offshore wind activities is provided in Appendix E1.

Accidental releases and discharges: However, should offshore wind facilities be located within the GAA, there is a possibility of accidental releases of fuels, oils, and lubricants that could affect wetland resources. Any activity would require a facility-specific spill plan outlining spill prevention training, plans, and steps to contain and clean up spills if they occur. Spills that reach surface water would be expected to disperse rapidly (BOEM 2015). Adverse impacts from accidental releases and discharges would be **negligible** adverse, localized, and temporary to short term due to the likely limited extent and duration of a release.

Permitted routine operational effluent discharges to receiving waters (e.g., such as ballast water) are regulated by the NPDES. Any discharges from future offshore wind projects are not expected to affect wetland resources within the GAA.

New cable emplacement/maintenance: Future offshore wind projects do not include cable emplacement and maintenance within the GAA that would affect wetland resources.

Presence of structures: There are no known future offshore wind activities that have facilities planned within the GAA. Therefore, impacts to wetland resources would be **negligible** adverse.

3.22.1.2 Conclusions

Under the No Action Alternative, there are no known future offshore wind activities that could impact wetland resources in the GAA. Adverse impacts from future activities on onshore wetland resources under the No Action Alternative would be temporary to short term and **negligible** adverse. Impacts associated with future offshore wind activities in the GAA for onshore wetland resources combined with ongoing activities, reasonably foreseeable environmental trends, and reasonably foreseeable activities other than offshore wind would result in **minor** adverse impacts because the effects would be small, and the resource would recover completely.

3.22.2 Environmental Consequences

3.22.2.1 Relevant Design Parameters, Impact-Producing Factors, and Potential Variances in Impacts

The Project design parameters that would influence the magnitude of the impacts on wetland resources include the location of and construction of or within the OnSS, ICF, and landfall work area. The following have occurred or would occur to minimize potential impacts to wetland resources:

- Revolution Wind evaluated siting alternatives for the OnSS using the criteria that included avoidance or minimization of disturbance to wetlands and other ecologically sensitive areas.
- The OnSS and ICF would be located on parcels that are already highly altered and include buried demolition waste.
- Revolution Wind would follow state and federal regulations for alteration of wetland resources.

Erosion control measures implemented during both construction and decommissioning, as well as a facility-specific spill plan implemented during O&M, would decrease the potential for impacts to wetland resources. These Project design parameters would be implemented across all alternatives; therefore, BOEM would not expect potential variances in impacts across the alternatives.

See Appendix E1 for a summary of IPFs analyzed for wetland and WOTUS resources across all action alternatives. IPFs that are either not applicable to the resource or determined by BOEM to have a negligible adverse effect are excluded from Chapter 3 and provided in Table E2-2 in Appendix E1. Offshore and onshore IPFs are addressed separately in the analysis if appropriate for the resource; not all IPFs have both an offshore and onshore component. Where feasible, calculations for specific alternative impacts are provided in Appendix E4, to facilitate reader comparison across alternatives.

Table 3.22-2 provides a summary of IPF findings carried forward for analysis in this section. Each alternative analysis discussion consists of the construction and installation phase, the O&M phase, the decommissioning phase, and the cumulative analysis. If these analyses are not substantially different, then they are presented as one discussion.

A detailed analysis of the Proposed Action is provided following the table. Detailed analysis of other considered action alternatives is also provided below the table if analysis indicates that the alternative(s) would result in substantially different impacts than the Proposed Action.

The Conclusion section within each alternative analysis discussion includes rationale for the overall effect call determination for that alternative. The overall impact of any alternative would be **minor** adverse because the effects on wetland resources would be small and localized, and with implementation of EPMs, wetland resources are expected to recover completely.

Table 3.22-2. Alternative Comparison Summary for Wetlands and Other Waters of the United States Impact-Producing Factor

Impact-Producing Factor	No Action Alternative	Alternative B (Proposed Action) up to 100 WTG	Alternative C (Habitat Alternative) 64–65 WTGs	Alternative D (Transit Alternative) 78–93 WTGs	Alternative E (Viewshed Alternative) 64–81 WTGs	Alternative F (Higher Capacity Turbine Alternative) 56 WTGs
Accidental releases and discharges	**Onshore**: Spills that reach surface water would be expected to disperse rapidly (BOEM 2015). Any discharges from future offshore wind projects are not expected to affect wetland resources within the GAA. Adverse impacts from accidental releases and discharges would be **negligible** adverse, localized, and temporary to short term due to the likely limited extent and duration of a release.	**Onshore**: Revolution Wind would prepare a construction-specific plan in accordance with applicable requirements and would outline spill prevention plans and steps to contain and clean up spills that may occur. All onshore activities would be conducted in compliance with the RI Pollutant Discharge Elimination System General Permit for the Discharge of Stormwater Associated with Construction Activities and an approved soil erosion and sedimentation control plan. Therefore, with the implementation of these measures, accidental releases and discharges during onshore construction and installation are expected to result in short-term **minor** adverse impacts within adjacent wetland resources. The potential for accidental releases and discharges during O&M and decommissioning would be less than during construction and installation due to reduced use of drilling fluids, fuels, oils, and lubricants. Stormwater runoff during O&M of onshore facilities could result in turbidity and sediment deposition that could cause short-term **minor** adverse impacts to wetlands or other WOTUS. Therefore, impacts to wetland resources from accidental releases and discharges would be short term **minor** adverse. The contribution from the Proposed Action would be a low percentage of the overall spill risk from ongoing and future activities in the GAA. Any ballast water discharges from the Proposed Action and future offshore wind projects are not expected to affect wetland resources within the GAA. As a result, the Proposed Action, when combined with past, present, and reasonably foreseeable projects, would result in short-term **negligible** to **minor** adverse impacts to wetland resources.	**Onshore**: Alternatives C through F would have the same onshore activities and facilities as the Proposed Action, therefore, impacts from accidental releases and discharges on wetland resources would be the same as those described for the Proposed Action: **negligible** to **minor** adverse.			
New cable emplacement/ maintenance	**Onshore**: Future offshore wind projects do not include cable emplacement and maintenance within the GAA that would affect wetland resources.	**Onshore**: No direct impacts to wetlands or other WOTUS would occur as a result of onshore cable emplacement or maintenance activities. Temporary soil disturbance during cable installation could disturb and alter nearby wetland habitat, as well as potentially spread invasive species, which could lead to a small, localized reduction in habitat quality. With erosion control and weed management measures in place, any impacts to adjacent wetlands during construction and installation would be short term **negligible** adverse. Land disturbance during O&M would be limited to regular maintenance of underground infrastructure, if needed, and EPMs would limit potential impacts from sedimentation. See Table F-1 in Appendix F for a list of EPMs for wetland resources. Adverse impacts on wetlands and WOTUS under the Proposed Action would be temporary **minor** adverse. The contribution to cumulative impacts to wetland resources from anchoring and cable emplacement is expected to be the same as the Proposed Action because no other past, present, and reasonably foreseeable projects requiring cable placement/maintenance would occur within the GAA. As a result, the Proposed Action, when combined with past, present, and reasonably foreseeable projects, would result in **minor** adverse short-term impacts to wetlands and WOTUS due to surface disturbance in wetland buffers.	**Onshore**: Alternatives C through F would have the same onshore activities and facilities as the Proposed Action, therefore impacts on wetland resources would be the same as the Proposed Action: **negligible** to **minor** adverse.			

Impact-Producing Factor	No Action Alternative	Alternative B (Proposed Action) up to 100 WTG	Alternative C (Habitat Alternative) 64–65 WTGs	Alternative D (Transit Alternative) 78–93 WTGs	Alternative E (Viewshed Alternative) 64–81 WTGs	Alternative F (Higher Capacity Turbine Alternative) 56 WTGs
Presence of structures	**Onshore**: There are no known future offshore wind activities that have facilities planned within the GAA. Therefore, impacts to wetland resources would be **negligible** adverse.	**Onshore:** Land disturbances from the presence of structures associated with Project construction and installation would include the 19.53-acre landfall work area, 7.04-acre OnSS, 3.76-acre ICF, and 16.58-acre onshore transmission cable envelope. The OnSS and ICF structures would permanently remove and replace 0.11 acre of freshwater forested wetland with impervious surface (less than 0.1% of wetlands within the GAA). Soil disturbance during construction and installation could also alter nearby wetland habitat due to sedimentation and spread invasive species, leading to a small, localized reduction in habitat quality. Revolution Wind would also comply with all permit and regulatory requirements related to wetland and other WOTUS impacts, and the resources are expected to recover with mitigation. As a result, adverse impacts on wetland resources under the Proposed Action would be localized, short term **minor** adverse. O&M of the ICF and OnSS would not impact wetlands or other WOTUS. Project components would be demolished or decommissioned in place, limiting the potential for soils and materials to wash into adjacent wetland resources. Temporary **minor** adverse impacts to wetlands or other WOTUS adjacent to the structures could occur if debris from demolition washed into the adjacent wetland resources. Additional structures could cumulatively add to other onshore impacts due to an increase in impervious surface from reasonably foreseeable structures within the GAA. The Proposed Action, when combined with past, present, and reasonably foreseeable projects, would result in long-term **minor** adverse impacts to wetland resources.	**Onshore**: Alternatives C through F would have the same onshore activities and facilities as the Proposed Action, therefore impacts would be the same as those described for the Proposed Action: **minor** adverse.			

3.22.2.2 Alternative B: Impacts of the Proposed Action on Wetlands and Other Waters of the United States

3.22.2.2.1 Construction and Installation

Onshore Activities and Facilities

Accidental releases and discharges: Onshore construction and HDD activities would require heavy equipment use, and an inadvertent release from the machinery or spill during refueling activities could occur. Onshore cables would not contain fluids and would not be susceptible to leaks that could affect water quality. The drilling rig used for HDD would be located within the landfall envelope where there are no wetlands or other WOTUS. Drilling fluids and mud would be transported off-site for treatment, disposal, and/or reuse. Revolution Wind would prepare a construction-specific plan in accordance with applicable requirements and would outline spill prevention plans and steps to contain and clean up spills that may occur.

To protect water quality, all onshore activities would be conducted in compliance with the RI Pollutant Discharge Elimination System General Permit for the Discharge of Stormwater Associated with Construction Activities and an approved soil erosion and sedimentation control plan. The measures employed in the soil erosion and sedimentation control plan would minimize the opportunity for turbid discharges leaving a construction work area. The plan would also include specific measures for handling dewatering discharges and measures for refueling equipment to minimize the opportunities for uncontrolled spills. Therefore, with the implementation of these measures, accidental releases and discharges during onshore construction and installation are expected to result in short-term **minor** adverse impacts within adjacent wetland resources.

New cable emplacement/maintenance: No direct impacts to wetlands or other WOTUS would occur as a result of onshore cable emplacement or maintenance activities. The landfall work area, which would be used during cable emplacement, avoids the nearby freshwater forested wetland (Freshwater Wetland 1) and wetland buffer (see Table 3.22-1). The onshore cable route would follow Circuit Drive and Camp Avenue to the OnSS, and no wetlands or other WOTUS are within the cable route. However, approximately 94 feet (28.65 m) of the onshore cable route crosses the 50-foot buffer of Freshwater Wetland 1, resulting in 0.07 acre of temporary disturbance in the buffer. Temporary soil disturbance during cable installation could disturb and alter nearby wetland habitat, as well as potentially spread invasive species, which could lead to a small, localized reduction in habitat quality. With erosion control and weed management measures in place, any impacts to adjacent wetlands during construction and installation would be short term **negligible** adverse. The cable corridor would be fully restored once construction and installation is complete.

Presence of structures: Land disturbances from the presence of structures associated with Project construction and installation would include the 19.53-acre landfall work area, 7.04-acre OnSS, 3.76-acre ICF, and 16.58-acre onshore transmission cable envelope. The new OnSS and ICF would be constructed adjacent to the existing Davisville Substation to support interconnection of the Project to the existing electrical grid. These structures would permanently remove and replace 0.11 acre of freshwater forested wetland with impervious surface. This amounts to 2.6% of the 3.92 acres of delineated wetlands within the OnSS and ICF parcels, and less than 0.1% of mapped wetlands in the GAA (Lower West Passage subwatershed). There are no streams or other waterbodies within the footprint of the onshore facilities;

however, Mill Creek is adjacent to the OnSS. Freshwater wetlands and wetland buffers within onshore components are detailed in Table 3.22-1 and in Figures 4.3.1-3 and 4.3.1-13 in COP Appendix K. Approximately 0.11 acre of freshwater wetlands and 143.38 feet of an Area Subject to Stormwater Flowage—regulated ditch—would be directly impacted by construction and installation of the onshore facilities. Clearing, grading, and hardening in these areas could directly and indirectly impact wetland resources. Soil disturbance during construction and installation could also alter nearby wetland habitat due to sedimentation (see Section 3.21) and spread invasive species, leading to a small, localized reduction in habitat quality. Impacts to wetlands would be permitted and mitigated as described in Appendix F, resulting in recovery of the resource. Implementing EPMs such as erosion and sedimentation BMPs (see Table F-1 in Appendix F) would avoid or minimize impacts on water quality, wetlands, and WOTUS. Revolution Wind would also comply with all permit and regulatory requirements related to wetland and other WOTUS impacts, and the resources are expected to recover with mitigation. As a result, adverse impacts on wetland resources under the Proposed Action would be localized, short term **minor** adverse.

3.22.2.2.2 Operations and Maintenance and Decommissioning

Onshore Activities and Facilities

Accidental releases and discharges: The potential for accidental releases and discharges during O&M and decommissioning would be less than during construction and installation due to reduced use of drilling fluids, fuels, oils, and lubricants. The additional impervious surfaces at onshore Project facilities during O&M would increase the amount of runoff and stormwater pollutants delivered to nearby wetland resources. Wetlands are important habitats for supporting wildlife, and stormwater runoff filtration and stormwater runoff during O&M could have a short-term effect on turbidity and sediment deposition that could impact wetlands or other WOTUS. Revolution Wind would prepare a construction-specific spill plan in accordance with applicable requirements and would outline spill prevention training, plans, and steps to contain and clean up spills that may occur. Therefore, impacts to wetland resources from accidental releases and discharges would be short term **minor** adverse.

New cable emplacement/maintenance: If O&M activities related to the onshore cable are within the segment of the ROW that crosses the 50-foot buffer of Freshwater Wetland 1, then temporary soil disturbance could alter nearby wetland habitat and spread invasive species, leading to a reduction in habitat quality. Land disturbance during O&M would be limited to regular maintenance of underground infrastructure (i.e., transmission cable discussed above under Section 3.22.2.2.1), if needed, and EPMs would limit potential impacts from sedimentation. Adverse impacts on wetlands and WOTUS under the Proposed Action would be temporary **minor** adverse.

Presence of structures: For onshore facilities, no land disturbance is anticipated during regular maintenance. O&M of the ICF and OnSS would not impact wetlands or other WOTUS. During decommissioning of the ICF and OnSS facilities, the Project components would be demolished or decommissioned in place, limiting the potential for soils and materials to wash into adjacent wetland resources. Pre-existing habitats are not likely to be restored as part of decommissioning. Temporary **minor** adverse impacts to wetlands or other WOTUS adjacent to the structures could occur if debris from demolition washed into the adjacent wetland resources.

3.22.2.2.3 Cumulative Impacts

Onshore Activities and Facilities

Accidental releases and discharges: The Proposed Action could contribute construction-related accidental releases of fuel, fluids, or hazardous material; sediment; and/or trash and debris. The contribution from the Proposed Action would be a low percentage of the overall spill risk from ongoing and future activities in the GAA. These types of releases, if any, would occur infrequently at discrete locations in the watershed and at varied times. As a result, the Proposed Action, when combined with past, present, and reasonably foreseeable projects, would result in short-term **negligible** adverse impacts to wetland resources.

Permitted routine operational effluent discharges to receiving waters are regulated by the NPDES. Any ballast water discharges from the Proposed Action and future offshore wind projects are not expected to affect wetland resources within the GAA. Stormwater runoff during O&M of onshore facilities could result in turbidity and sediment deposition that could cause short-term **minor** adverse impacts to wetlands or other WOTUS. Overall, the contribution to cumulative impacts to wetland resources is expected to be localized, temporary **minor** adverse.

New cable emplacement/maintenance: The contribution to cumulative impacts to wetland resources from anchoring and cable emplacement is expected to be the same as the Proposed Action because no other past, present, and reasonably foreseeable projects requiring cable placement/maintenance would occur within the GAA. As a result, the Proposed Action, when combined with past, present, and reasonably foreseeable projects, would result in **minor** adverse short-term impacts to wetlands and WOTUS due to surface disturbance in wetland buffers.

Presence of structures: The Proposed Action includes the OnSS and ICF structures that would remove and replace 0.11 acre of freshwater forested wetland with impervious surface, which is less than 0.1% of mapped wetlands in the GAA (Lower West Passage subwatershed) and 2.6% of wetlands delineated in those parcels. Additional structures could cumulatively add to other onshore impacts due to an increase in impervious surface from reasonably foreseeable structures within the GAA; however, only a small percentage of the 1,367.4 acres of freshwater wetlands are expected to be impacted. The Proposed Action, when combined with past, present, and reasonably foreseeable projects, would result in long-term **minor** adverse impacts to wetland resources.

3.22.2.2.4 Conclusions

Project construction and installation, O&M, and decommissioning would expose and disturb soils and sediments, resulting in potential erosion, sedimentation, or inadvertent release of contamination, hazardous materials or debris into onshore surface waters that could affect wetland resources in the GAA. BOEM anticipates the impacts resulting from the Proposed Action alone would range from **negligible** to **minor** adverse because the effect would be small and localized. Further, the resource would be expected to recover completely with remedial or mitigating action(s). The Proposed Action would not result in any net beneficial change to wetlands or other WOTUS.

In the context of other reasonably foreseeable environmental trends and planned actions, the impacts under the Proposed Action resulting from individual IPFs would range from **negligible** to **minor** adverse. Considering all IPFs together, BOEM anticipates that the overall impacts associated with the Proposed

Action when combined with past, present, and reasonably foreseeable activities would result in **minor** adverse impacts to wetlands and WOTUS because the effects are expected to be small and localized. Further, with implementation of EPMs, wetland resources are expected to recover completely.

3.22.2.3 Alternatives C, D, E, and F

Table 3.22-2 discloses IPF findings for each alternative.

3.22.2.3.1 Conclusions

Under Alternatives C through F, Project construction and installation, O&M, and decommissioning would expose and disturb soils and sediments, resulting in potential erosion, sedimentation, or inadvertent release of contamination, hazardous materials, or debris into onshore surface waters that could affect wetland resources in the GAA. BOEM anticipates that impacts resulting from each alternative alone would range from **negligible** to **minor** adverse because the effect would be small and localized. Further, the resource would be expected to recover completely with remedial or mitigating action(s). Alternatives C through F would not result in any net beneficial change to wetlands or other WOTUS.

In the context of other reasonably foreseeable environmental trends and planned actions, the impacts under Alternatives C through F resulting from individual IPFs would range from **negligible** to **minor** adverse. Considering all the IPFs together, BOEM anticipates that the overall impacts associated with each alternative, when combined with past, present, and reasonably foreseeable activities, would result in **minor** adverse impacts to wetlands and WOTUS because the effects are expected to be small and localized. Further, with implementation of EPMs, wetland resources are expected to recover completely.

3.22.2.4 Mitigation

No potential additional mitigation measures for wetland resources are identified in Table F-2 in Appendix F.